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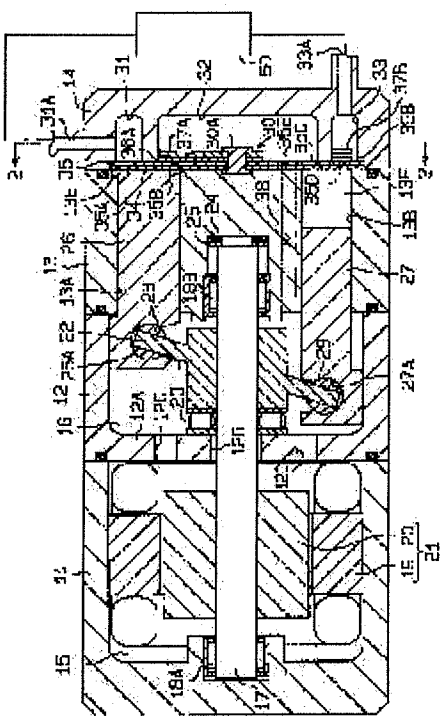
(54) MOTOR-DRIVEN SWASH PLATE COMPRESSOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a motor-driven compressor capable of reducing the size and weight of the machine body and of cooling the motor chamber and a swash plate chamber effectively.
SOLUTION: The compressor is equipped with a motor 21, a swash plate 22, and a motor chamber 15 and swash plate chamber 16 accommodating them. The compressor is furnished with a passage to generate communication to the motor chamber 15, of that portion of the intra-case refrigerant passage other than the discharge chamber 33 connected with an external refrigerant circuit. Because the communication passage is configured so that the swash plate chamber 16 is included, a refrigerant gas having a lower temperature and lower pressure than the discharged refrigerant is supplied to the motor chamber 15 and swash plate chamber 16.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The motor housing, cam-plate room and cylinder bore which were formed in the case, and the piston which performs a compression operation while holding possible [reciprocation] in said cylinder bore, While being supported pivotable in said case in the condition of having been inserted in said motor housing and the cam-plate room and connecting with the electric motor of this motor interior of a room In the electric cam-plate compressor equipped with the driving shaft which carries out both-way actuation of said piston by actuation of said motor through the cam plate arranged in said cam-plate interior of a room The electric cam-plate compressor characterized by including said cam-plate room on this free passage way while the free passage way which opens for free passage the parts and said motor housings other than the regurgitation room opened for free passage by the external refrigerant circuit among the refrigerant paths within a case of said compressor is prepared.
[Claim 2] It is the electric cam-plate compressor according to claim 1 characterized by for said compressor being a multistage type compressor equipped with the 1st cylinder bore which inhales and compresses the inhalation refrigerant from an external refrigerant circuit, and other cylinder bores which inhale and compress the refrigerant of the intermediate pressure compressed once [at least], and said free passage way opening for free passage the intermediate pressure room where the refrigerant of said intermediate pressure exists, and said motor housing.
[Claim 3] It is the electric cam-plate compressor according to claim 1 or 2 characterized by arranging said motor housing at the upstream rather than said cam-plate room in said free passage way, and passing through this cam-plate room after some refrigerants [at least] pass this motor housing.
[Claim 4] Said free passage way is an electric cam-plate compressor according to claim 1 characterized by opening either and said motor housing for free passage at least among the inhalation holes which introduce into this inhalatorium the inhalatorium and this inhalation refrigerant with which the inhalation refrigerant from said external refrigerant circuit exists.
[Claim 5] It is the electric cam-plate compressor according to claim 4 characterized by being arranged at the upstream of said motor housing and a cam-plate room while it has the branching free passage way by which the branching was carried out from said inhalatorium or the inhalation hole and this branching free passage way constitutes the refrigerant path within a case of said compressor.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the electric cam-plate compressor used for example, for the air conditioner for cars.
[0002]
[Description of the Prior Art] The electrically-driven compressor is known as a compressor built into the refrigerant circulator of heat exchange equipments, such as an air conditioner for cars. Generally the electrically-driven compressor is equipped with the refrigerant compressor style driven by the electric motor and this motor in the case used as that coat. This refrigerant compressor style consists of a piston held in the cylinder bore in a compressor possible [reciprocation], a cam plate which is formed in the cam-plate room by which partition formation was carried out into the compressor, and changes rotation of said motor into the reciprocating motion of this piston. Since this motor is expected the rotational capacity which realizes a high revolution, and the driving force which can bear high load torque, said compressor needs to be equipped with a high power motor. However, in the configuration of opposing a high revolution load as it is also with a high power motor, it will be urged to high generation-of-heat-ization of a motor and ambient temperature lifting of this motor will be promoted further. Though this ambient temperature lifting is natural, in order to make this motor itself into an elevated temperature, a risk called decline in the revolution effectiveness which the demagnetization of a motor own [by this elevated-temperature-izing / this] causes hangs around. Therefore, motor cooling for avoiding elevated-temperature-ization of this motor is needed.
[0003] Moreover, if the high-speed revolution of said cam plate is carried out, since it will be in a high temperature condition by the sliding friction with the shoe infixed between said pistons, from the field of endurance or sliding stability, cooling of this cam plate is also combined and is needed.
[0004] The thing of introducing the refrigerant in a compressor into the motor housing equipped with this motor as a configuration for said motor cooling is known (JP,7-133779,A). This configuration introduces into said motor housing the regurgitation refrigerant in the condition of it being breathed out from said refrigerant compressor style, and being sent to the equipment (for example, condenser) of the external downstream of said compressor, and performed motor cooling.
[0005] Moreover, what introduces into said motor housing the inhalation refrigerant inhaled by this compressor from the equipment (for example, evaporator) of the external upstream of said compressor, and performs motor cooling to JP,9-236092,A is indicated.
[0006]
[Problem(s) to be Solved by the Invention] However, with the former configuration, when the regurgitation refrigerant used for cooling of a motor is made a high-pressure and elevated temperature condition by compression by said refrigerant compressor style and the refrigerant of such a condition is used for said motor cooling, the following two technical problems are induced.
[0007] Small lightweight-ization of said case will be obstructed by using a high voltage regurgitation refrigerant for the 1st first. That is, a rise on the strength, i.e., the thick increment in a case, duplication,

thick buildup of the reinforcement member inside a case, etc., for said motor housing to be a field where the rate of a capacity factor is comparatively big, and bear said case in a compressor, at the high voltage condition is needed.

[0008] Since the refrigerant itself used [2nd] for cooling is an elevated temperature, said motor cooling becomes an inefficient thing. on the other hand, only installation of the refrigerant to said motor housing is indicated for both configuration -- **** -- it does not pass and disclosure about cooling of said cam plate is not performed. That is, the actual condition is that the response over overheating of a cam plate is not taken into consideration.

[0009] The object of this invention enables small lightweight-ization of an airframe, and is to offer the electric cam-plate compressor which can cool a motor housing and a cam-plate room efficiently.

[0010]

[Means for Solving the Problem] In order to solve the above-mentioned trouble, invention according to claim 1 The motor housing, cam-plate room and cylinder bore which were formed in the case, and the piston which performs a compression operation while holding possible [reciprocation] in said cylinder bore, While being supported pivotable in said case in the condition of having been inserted in said motor housing and the cam-plate room and connecting with the electric motor of this motor interior of a room In the electric cam-plate compressor equipped with the driving shaft which carries out both-way actuation of said piston by actuation of said motor through the cam plate arranged in said cam-plate interior of a room While the free passage way which opens for free passage the parts and said motor housings other than the regurgitation room opened for free passage by the external refrigerant circuit among the refrigerant paths within a case of said compressor is prepared, let it be a summary to include said cam-plate room on this free passage way.

[0011] According to this invention, the motor housing and cam-plate room of an electric cam-plate compressor are that the refrigerant within the refrigerant path within a case is introduced through a free passage way, and both the interior of a room is cooled. the refrigerant, i.e., the regurgitation refrigerant, of the regurgitation interior of a room where the refrigerant introduced into both the interior of a room is opened for free passage by the external refrigerant circuit -- low temperature -- since it is in a low voltage condition, as compared with the configuration which uses a regurgitation refrigerant for cooling, whenever [both room air temperature], and a pressure will be fallen more That is, while raising cooling effectiveness, reduction of the pressure resistance of a case is enabled.

[0012] Invention according to claim 2 is the multistage type compressor equipped with the 1st cylinder bore into which said compressor inhales and compresses the inhalation refrigerant from an external refrigerant circuit, and other cylinder bores which inhale the refrigerant of the intermediate pressure compressed once [at least], and are compressed in invention according to claim 1, and said free passage way makes it a summary to open for free passage the intermediate pressure room where the refrigerant of said intermediate pressure exists, and said motor housing.

[0013] According to this invention, said motor housing and a cam-plate room are cooled with the intermediate pressure refrigerant breathed out by the intermediate pressure room of a multistage type compressor. Since an intermediate pressure refrigerant is fully low-temperature low voltage, it is more suitable than said regurgitation refrigerant for reduction of the improvement in cooling effectiveness, and case pressure resistance.

[0014] After said motor housing is arranged for invention according to claim 3 in invention according to claim 1 or 2 at the upstream rather than said cam-plate room in said free passage way and some refrigerants [at least] pass this motor housing, let it be a summary to pass through this cam-plate room.

[0015] According to this invention, before said cam-plate room is cooled, said motor housing is cooled. That is, since this motor housing is cooled with the low temperature refrigerant which has not carried out a temperature rise at least in this cam-plate interior of a room, the cooling effectiveness of this motor housing improves further.

[0016] Invention according to claim 4 makes it a summary for said free passage way to open either and said motor housing for free passage at least among the inhalation holes which introduce into this inhalatorium the inhalatorium and this inhalation refrigerant with which the inhalation refrigerant from

said external refrigerant circuit exists in invention according to claim 1.
[0017] According to this invention, the inhalation refrigerant from said external refrigerant circuit is introduced into said motor housing and a cam-plate room. This inhalation refrigerant is low-temperature low voltage more nearly further than said intermediate pressure refrigerant. Therefore, for reduction of the improvement in cooling effectiveness, and case pressure resistance, it can be said that it is still more suitable.
[0018] While invention according to claim 5 has the branching free passage way by which the branching was carried out from said inhalatorium or the inhalation hole in invention according to claim 4 and this branching free passage way constitutes the refrigerant path within a case of said compressor, let it be a summary to be arranged at the upstream of said motor housing and a cam-plate room.
[0019] According to this invention, said inhalation refrigerant is introduced into said motor housing and a cam-plate room through a branching free passage way. Although these some inhalation refrigerants are introduced into both ** in that case, a part is inhaled by the cylinder bore, without being introduced into both **. Therefore, since the inhalation refrigerant elevated-temperature-ized in both the interior of a room is only only the part, the temperature of the refrigerant inhaled in said cylinder bore does not rise comparatively. That is, decline in the compression efficiency which buildup of the specific volume accompanying the temperature rise of the refrigerant inhaled by this cylinder bore causes is suppressed.
[0020]
[Embodiment of the Invention] (1st operation gestalt) The 1st operation gestalt materialized to the multistage-type electric cam-plate compressor which uses a carbon dioxide by using this invention as a refrigerant hereafter is explained according to drawing 1 and drawing 2 . In addition, make the left of drawing 1 into the front of a compressor, and let the method of the right be back.
[0021] As shown in drawing 1 , the electric cam-plate compressor is equipped with the motor housing 11, the front housing 12, a cylinder block 13, and the rear housing 14. Each [these] housing 11, 12, and 14 and a cylinder block 13 constitute the case of this compressor in which junction immobilization was mutually carried out by two or more through bolts which are not illustrated and that carried out the shape of a cylindrical shape mostly. In the field where the motor housing 15 was surrounded by the front housing 12 and the cylinder block 13 in the field surrounded by the motor housing 11 and the front housing 12, partition formation of the cam-plate room 16 is carried out, respectively.
[0022] Between the motor housing 11 and a cylinder block 13, the driving shaft 17 inserted in the motor housing 15 and the cam-plate room 16 is supported pivotable through the radial bearings 18A and 18B of an order couple. The driving shaft 17 has fitted in loosely feed-hole 12B of wall 12A formed in the front housing 12.
[0023] The electric motor 21 which consists of a stator 19 and Rota 20 really fixed pivotable on the driving shaft 17 is held by the motor housing 15. At the cam-plate room 16, on a driving shaft 17, the cam plate 22 of a disc configuration is really fixed pivotable, and thrust bearing 23 is arranged between a cam plate 22 and wall 12A. The driving shaft 17 and cam plate 22 which were unified are positioned in the thrust direction (the direction of a driving shaft axis) by the washer 25 by which front energization was carried out with the spring 24 arranged in the hold crevice formed in the center of a cylinder block 13, and thrust bearing 23.
[0024] It is formed in the location where 2nd cylinder bore 13B as other cylinder bores formed in the minor diameter counters a cylinder block 13 on both sides of a driving shaft 17 mutually rather than 1st cylinder bore 13A and this cylinder bore 13A. The 1st and 2nd pistons 26 and 27 of a piece head form are held in the cross direction by each cylinder bores 13A and 13B possible [both-way sliding], respectively, and the compression space 13E and 13F which carries out a volume change according to both-way sliding of each pistons 26 and 27 is divided in each boa 13A and 13B, respectively. Crevices 26A and 27A are established in the front section of each pistons 26 and 27, respectively, and the shoes 28 and 29 of a couple are held in these crevices 26A and 27A. When the periphery section of a cam plate 22 is pinched by both the shoes 28 and 29 possible [sliding], actuation connection of each pistons 26 and 27 is carried out at the cam plate 22. For this reason, with a revolution of the driving shaft 17 by said electric motor 21, rotation of a cam plate 22 is changed into a both-way rectilinear motion of each

pistons 26 and 27 in the stroke corresponding to whenever [that tilt-angle] because a cam plate 22 carries out a synchronous revolution with this driving shaft 17.
[0025] Between a cylinder block 13 and the rear housing 14, the valve organizer 30 is inserted into both, and is made and prepared. As shown in drawing 1 and drawing 2 , between the valve organizer 30 and the rear housing 14, the inhalatorium 31 where the inhalation refrigerant from the external refrigerant circuit 50 is introduced through inhalation hole 31A prepared in the peripheral wall of the rear housing 14 is formed. Furthermore, partition formation of the intermediate pressure room 32 which connects each cylinder bore 13A and 13B, and the regurgitation room 33 opened for free passage by the external refrigerant circuit 50 through discharge opening 33A prepared in the posterior wall of stomach of the rear housing 14 is carried out.
[0026] The valve organizer 30 becomes the suction valve portion formation member 34, the port formation member 35, the 1st and 2nd discharge valves 36A and 36B, 1st and 2nd retainer 37A, and 37B list from Pins 30A and 30C.
[0027] Ports 35A, 35B, 35C, 35D, and 35E are formed in the port formation member 35. Port 35A makes an inhalatorium 31 and 1st cylinder bore 13A open for free passage, and port 35B makes 1st cylinder bore 13A and the intermediate pressure room 32 open for free passage. Moreover, port 35C makes 2nd cylinder bore 13B and the intermediate pressure room 32 open for free passage, and port 35D makes 2nd cylinder bore 13B and the regurgitation room 33 open for free passage. Furthermore, port 35E makes the intermediate pressure room 32 and the cam-plate room 16 open for free passage through the free passage hole 38 mentioned later.
[0028] Moreover, the suction valve portion is formed in the location adjusted in the suction valve portion formation member 34 in Ports 35A and 35C. Furthermore, in the intermediate pressure room 32, discharge valve 36A and retainer 37A are being fixed to the suction valve portion formation member 34 and the port formation member 35 by pin 30A. Moreover, as shown in drawing 2 , in the regurgitation room 33, discharge valve 36B and retainer 37B are being fixed to both the formation members 34 and 35 by pin 30C.
[0029] In addition, the refrigerant path within a case is constituted by the inhalation hole 31A, inhalatorium 31, port 35A, 1st cylinder bore 13A, port 35B, intermediate pressure room 32, port 35C, and 2nd cylinder bore the 13B, port 35D, the regurgitation room 33, and discharge opening 33A.
[0030] The free passage hole 38 which makes the intermediate pressure room 32 and the cam-plate room 16 open for free passage is formed in the cylinder block 13. Moreover, free passage hole 12C which makes the cam-plate room 16 and a motor housing 15 open for free passage is formed in wall 12A of the front housing 12. The free passage way which opens the intermediate pressure room 32 and a motor housing 15 for free passage by feed-hole 12B of the free passage hole 38, the cam-plate room 16, and the front housing 12 and free passage hole 12C is constituted.
[0031] Next, an operation of the compressor constituted as mentioned above is explained. If a driving shaft 17 rotates with an electric motor 21, a cam plate 22 will rotate to one. Both-way actuation of each pistons 26 and 27 is carried out through shoes 28 and 29 with a revolution of a cam plate 22, respectively. In each compression space 13E and 13F, inhalation of a refrigerant, compression, and the regurgitation are successively repeated by continuation of this actuation.
[0032] If the refrigerant from inhalation hole 31A to an inhalatorium 31 is inhaled by compression space 13E through port 35A, the intermediate pressure room 32 will breathe out the compression operation by the setback of the 1st piston 26 through port 35B after a carrier beam.
[0033] Furthermore, some refrigerants in this intermediate pressure room 32 are inhaled by compression space 13F through port 35C, and it is breathed out by the regurgitation room 33 through port 35D after the compression operation by migration of the 2nd piston 27. The refrigerant breathed out by the regurgitation room 33 is sent out to the external refrigerant circuit 50 from discharge opening 33A.
[0034] On the other hand, although not inhaled by compression space 13F among the refrigerants in the above-mentioned intermediate pressure room 32, at least a part passes port 35E and the free passage hole 38, and is supplied to the cam-plate room 16. Furthermore, a motor housing 15 is supplied from the cam-plate room 16 through feed-hole 12B of thrust bearing 23 and the front housing 12, and free

passage hole 12C. Supply of a refrigerant in this motor housing 15 or the cam-plate room 16 is effectively performed by Rota 20 accompanying a revolution of an electric motor 21, and stirring by revolution of a cam plate 22. And an electric motor 21 is cooled with the refrigerant supplied to the motor housing 15, and a cam plate 22 and a shoe 28, and 29 grades are cooled with the refrigerant supplied to the cam-plate room 16.

[0035] Moreover, the refrigerant in the intermediate pressure room 32 is fully low temperature as compared with the refrigerant in the regurgitation room 33 which is only a carrier beam and was compressed within both said two compression space 13E and 13F in the compression operation within compression space 13E, and low voltage cannot be overemphasized.

[0036] According to this operation gestalt, the following effectiveness can be acquired.

(1) For cooling of a motor housing 15 and the cam-plate room 16, the refrigerant in the sufficiently low voltage intermediate pressure room 32 is introduced rather than the regurgitation room 33. Therefore, it becomes possible to set up low the pressure resistance of this case of a part that does not expose the inside of a motor housing 15 and the cam-plate room 16 to the pressure as the refrigerant pressure force in the regurgitation room 33, and corresponds with a motor housing 15 and the cam-plate room 16. Therefore, the miniaturization and the improvement in endurance in a case can be aimed at. Moreover, rather than the thing in the regurgitation room 33, since the refrigerant in the intermediate pressure room 32 is low temperature enough, it can cool a motor housing 15 efficiently. Consequently, also when high-speed operation is performed or a heavy load is applied to a motor 21, demagnetization of this motor 21 is prevented.

[0037] (2) The refrigerant in the intermediate pressure room 32 is introduced not only into the motor housing 15 but into the cam-plate room 16. That is, the large area within a compressor case is covered and cooling within this case is performed. Therefore, when a heavy load is applied to a high speed driving time or a motor 21, overheating of the shoes 28 and 29 can be prevented.

[0038] (3) Moreover, the installation to the cam-plate room 16 of the refrigerant in the intermediate pressure room 32 enables efficient cooling of bearings 18B and 23, a cam plate 22, shoes 28 and 29, pistons 26 and 27, and a lubricating oil (contained in the state of Myst in a carbon dioxide). That is, degradation by degradation of the lubricating oil by sliding of each part material (bearings 18B and 23, a cam plate 22, shoes 28 and 29, and pistons 26 and 27) in an elevated temperature condition and elevated-temperature-izing of the lubricating oil itself can be suppressed.

[0039] Furthermore, the pressure in the cam-plate room 16 turns into the same intermediate pressure as the pressure in the intermediate pressure room 32 by installation to the cam-plate room 16 of the refrigerant in the intermediate pressure room 32. That is, the pressure which acts on a before [the 1st piston 26] side, and the pressure which acts on the backside [this piston 26] at the time of the regurgitation of compression space 13E will be in an almost equal condition. Moreover, the pressure differential of the pressure which acts on a before [the 2nd piston 27] side, and the pressure which acts on the backside [this piston 27] at the time of the regurgitation of compression space 13F also becomes small compared with the former. That is, since the pressure differential before each pistons 26 and 27 when being in the regurgitation process to which the load load concerning each pistons 26 and 27 becomes the largest, and on the backside decreases, the force of acting on a cam plate 22, shoes 28 and 29, and pistons 26 and 27 becomes small. Therefore, degradation of the lubricating oil by sliding [heavy load / between each part material (a cam plate 22, shoes 28 and 29, and pistons 26 and 27)] can be suppressed.

[0040] (4) The refrigerant in the intermediate pressure room 32 is already a carrier beam refrigerant about a compression operation in compression space 13E, and is an elevated temperature from the refrigerant in an inhalatorium 31. Therefore, there are few degrees of a refrigerant temperature rise as compared with the configuration using the refrigerant introduced from the inhalatorium 31 with the configuration of the above-mentioned operation gestalt which cools a motor housing 15 using the introduced refrigerant from the intermediate pressure room 32. That is, it is hard to be influenced of the compression efficiency lowering by the increment in specific volume of a refrigerant.

[0041] (The 2nd operation gestalt: Refer to drawing 3 and drawing 4) The electric cam-plate

compressor of this 2nd operation gestalt changes the configuration of the refrigerant path within a case, and a free passage way in said 1st operation gestalt, and has the same composition as the electric cam-plate compressor of the 1st operation gestalt in respect of others. Therefore, about the component which is common in the 1st operation gestalt, the explanation which attached the same sign and overlapped on the drawing is omitted.

[0042] Between the valve organizer 30 and the rear housing 14, partition formation of the two intermediate pressure rooms 32A and 32B other than an inhalatorium 31 and the regurgitation room 33 is carried out. 1st intermediate pressure room 32A is opened for free passage by port 35B and hole 30B mentioned later, and 2nd intermediate pressure room 32B is opened for free passage by Ports 35C and 35E.

[0043] Hole 30B which penetrates pin 30A to shaft orientations is formed in pin 30A. Cylinder block feed-hole 13C which opens for free passage the hold crevice in which the back end section of a driving shaft 17 is held, and hole 30B is formed in the cylinder block 13. Driving shaft free passage hole 17A which opens the front region in a motor housing 15 and cylinder block feed-hole 13C for free passage is formed in the driving shaft 17. Moreover, the free passage hole 38 which makes the cam-plate room 16 and port 35E always open for free passage is formed in the cylinder block 13. Therefore, the free passage way which always opens between both intermediate pressure room 32A and 32B for free passage through a motor housing 15 is constituted by each holes 30B, 13C, 17A, 12B, 12C, and 38, port 35E, and the cam-plate room 16.

[0044] In addition, in addition to this free passage way and motor housing 15, the refrigerant path within a case is constituted by the inhalation hole 31A, inhalatorium 31, port 35A, 1st cylinder bore 13A, port 35B, 1st and 2nd intermediate pressure roomA [32] and 32B, port 35C, and 2nd cylinder bore the 13B, port 35D, the regurgitation room 33, and discharge opening 33A.

[0045] The refrigerant which was inhaled by 1st cylinder bore 13A and compressed into it from the inhalatorium 31 is breathed out by 1st intermediate pressure room 32A through port 35B. And the refrigerant in this 1st intermediate pressure room 32A is introduced into the front region in a motor housing 15 through hole 30B, cylinder block feed-hole 13C, and driving shaft free passage hole 17A. Furthermore, after the refrigerant introduced in this motor housing 15 passes through the clearance between a stator 19 and Rota 20, it is introduced into the cam-plate room 16 through free passage hole 12C and feed-hole 12B and thrust bearing 23. Then, the refrigerant in the cam-plate room 16 is introduced into 2nd intermediate pressure room 32B through the free passage hole 38.

[0046] After the refrigerant in 2nd intermediate pressure room 32B is inhaled by 2nd cylinder bore 13B through port 35C, it is further compressed by the 2nd piston 27 and is breathed out by the external refrigerant circuit through port 35D, the regurgitation room 33, and discharge opening 33A.

[0047] According to this operation gestalt, the following effectiveness other than the effectiveness of (1) - (4) of said operation gestalt can be acquired.

(5) A motor housing 15 and the cam-plate room 16 are included in the only refrigerant path within a case in which it does not have other bypass paths, and it was made for a refrigerant to pass through the inside of both ** 15 and 16 compulsorily. Therefore, as compared with said operation gestalt, the cooling effect in both ** 15 and 16 improves.

[0048] (6) After introducing first the refrigerant in 1st intermediate pressure room 32A into a motor housing 15, it is introduced into the cam-plate room 16. That is, the refrigerant in 1st intermediate pressure room 32A is directly introduced into the motor housing 15 from this intermediate pressure room 32A, without minding the cam-plate room 16. Therefore, a motor housing 15 can be more efficiently cooled with the refrigerant of the low-temperature condition before passing through the cam-plate room 16.

[0049] (7) It is constituted so that the refrigerant introduced into the front region of a motor housing 15 may pass to the back region of a motor housing 15 through the clearance between a stator 19 and Rota 20. That is, a refrigerant cools the large area of the front face of an electric motor 21. Thereby, an electric motor 21 can be cooled efficiently.

[0050] (The 3rd operation gestalt: Refer to drawing 5 </A> and drawing 6) The electric cam-plate

compressor of this operation gestalt changes the configuration of the refrigerant path within a case, and a free passage way in said 2nd operation gestalt, and has the same composition as the electric cam-plate compressor of the 2nd operation gestalt in respect of others. Therefore, about the component which is common in the 2nd operation gestalt, the explanation which attached the same sign and overlapped on the drawing is omitted.

[0051] As shown in drawing 6 , extension formation of the 2nd intermediate pressure room 32B is carried out to near the periphery section of the rear housing 14. The free passage hole 40 is formed in a driving shaft 17 and parallel at the peripheral face top of a compressor case (drawing 6 rear housing 14) in the heights 39 as a refrigerant cooling means by which swelling formation was carried out. A motor housing 15 and intermediate pressure room 32B are opened for free passage through the free passage hole 40 and port 35F.

[0052] The motor housing 11, the front housing 12, and a cylinder block 13 are covered, penetration formation is carried out, and the free passage hole 40 is always opening the front region in port 35 F and a motor housing 15 for free passage.

[0053] Penetration formation of the cylinder block free passage hole 13D which opens the cam-plate room 16 and hole 30B for free passage is carried out at the cylinder block 13. Therefore, the free passage way which always opens between both intermediate pressure room 32A and 32B for free passage through a motor housing 15 is constituted by each holes 30B, 13D, 12B, 12C, and 40, port 35F, and the cam-plate room 16.

[0054] In addition, in addition to this free passage way and motor housing 15, the refrigerant path within a case is constituted by the inhalation hole 31A, inhalatorium 31, port 35A, 1st cylinder bore 13A, port 35B, 1st and 2nd intermediate pressure roomA [32] and 32B, port 35C, and 2nd cylinder bore the 13B, port 35D, the regurgitation room 33, and discharge opening 33A.

[0055] With this operation gestalt, the intermediate pressure refrigerant in 1st intermediate pressure room 32A is introduced into the cam-plate room 16 through hole 30B and cylinder block free passage hole 13D. The refrigerant in the cam-plate room 16 is introduced into the back region in a motor housing 15 through free passage hole 12C of the front housing 12, feed-hole 12B, and thrust bearing 23. After the refrigerant introduced into this motor housing 15 passes through the clearance between a stator 19 and Rota 20, it is introduced in opening of the free passage hole 40 formed in the front region in a motor housing 15, and is introduced into 2nd intermediate pressure room 32B through the free passage hole 40 and port 35F. After the refrigerant in 2nd intermediate pressure room 32B is inhaled by compression space 13F through port 35C, it is further compressed by the 2nd piston 27 and is breathed out by the external refrigerant circuit through port 35D, the regurgitation room 33, and discharge opening 33A.

[0056] According to this operation gestalt, the following effectiveness other than the effectiveness of aforementioned (1) - (5) can be acquired.

(8) After introducing first the refrigerant in 1st intermediate pressure room 32A into the cam-plate room 16, it is introduced into the motor housing 15. That is, the refrigerant in 1st intermediate pressure room 32A is directly introduced into the cam-plate room 16 from this intermediate pressure room 32A, without minding a motor housing 15. Therefore, the cam-plate room 16 can be more efficiently cooled with the refrigerant of the low-temperature condition before passing a motor housing 15.

[0057] (9) The refrigerant which passed through the 1st cam-plate room 16 from intermediate pressure room 32A and motor housing 15 passes the free passage hole 40, and it was made to result in 2nd intermediate pressure room 32B. Since this free passage hole 40 is formed in the heights which projected further from the periphery section of a compressor case, it tends to miss the heat in the free passage hole 40 to the compressor exterior. Therefore, the refrigerant which passes this free passage hole 40 will result in 2nd intermediate pressure room 32B, after being cooled. That is, since the refrigerant with which it was low-temperature-ized and specific volume decreased is inhaled by 2nd cylinder bore 13B, improvement in compression efficiency can be aimed at.

[0058] (The 4th operation gestalt: Refer to drawing 7 and drawing 8) The electric cam-plate compressor of this operation gestalt changes the configuration of the refrigerant path within a case, and a free passage way in said 1st operation gestalt, and has the same composition as the electric cam-plate

compressor of the 1st operation gestalt in respect of others. Therefore, about the component which is common in the 1st operation gestalt, the explanation which attached the same sign and overlapped on the drawing is omitted.

[0059] Port 35G are always which makes a cylinder block 13 open an inhalatorium 31 and the cam-plate room 16 for free passage with the free passage hole 41 by which penetration formation was carried out a free passage port among each ports 35A, 35B, 35C, 35D, and 35G currently formed in the port formation member 35.

[0060] Moreover, the front region of a motor housing 15 is this inhalation hole 31A and always open for free passage with the branching free passage way 42 by which the branching was carried out from inhalation hole 31A. The branching free passage way 42 covers the motor housing 11, the front housing 12, a cylinder block 13, and the rear housing 14, and penetration formation is carried out between a motor housing 15 and inhalation hole 31A.

[0061] In addition, the free passage way which always opens inhalation hole 31A and an inhalatorium 31 for free passage through a motor housing 15 is constituted by the branching free passage way 42, Holes 12B and 12C, the cam-plate room 16, the free passage hole 41, and port 35G. Moreover, a part of refrigerant path within a case is constituted by this free passage way and motor housing 15.

[0062] Some refrigerants inhaled by inhalation hole 31A from the external refrigerant circuit 50 pass inhalation hole 31A as it is, it reaches an inhalatorium 31, and other refrigerants are introduced into the branching free passage way 42, and reach the front region of a motor housing 15. After the refrigerant introduced into this motor housing 15 passes through the clearance between a stator 19 and Rota 20, it is introduced into the cam-plate room 16 through free passage hole 12C and feed-hole 12B and thrust bearing 23. Then, the refrigerant in the cam-plate room 16 is introduced into an inhalatorium 31 through the free passage hole 41.

[0063] According to this operation gestalt, the following effectiveness can be acquired.

(10) The inhalation refrigerant before being compressed is introduced into the motor housing 15 and the cam-plate room 16. That is, the refrigerant of the low-temperature condition before carrying out a temperature rise according to a compression operation is used. Therefore, a motor housing 15 and the cam-plate room 16 can be cooled more.

[0064] (11) Form the branching free passage way 42 by which the branching was carried out from inhalation hole 31A, some inhalation refrigerants from the external refrigerant circuit 50 are made to go via a motor housing 15 and the cam-plate room 16, and an inhalatorium 31 and the remainder were introduced to the direct inhalatorium 31. That is, the refrigerant by which temperature up is carried out within both ** 15 and 16 is used as some inhalation refrigerants from the external refrigerant circuit 50, and the temperature up of the remaining inhalation refrigerants was made not to be carried out. Therefore, since the temperature rise of the refrigerant inhaled by compression space 13E is suppressed, decline in the compression efficiency by the increment in the specific volume of a refrigerant can be suppressed.

[0065] (12) In a motor housing 15 and the cam-plate room 16, the sufficiently low voltage inlet-pressure refrigerant is introduced rather than the refrigerant breathed out by the regurgitation room 33 and also the intermediate pressure room 32. Therefore, the miniaturization and the improvement in endurance in a compressor case can be aimed at.

[0066] (13) After introducing first the refrigerant from the branching free passage way 42 into a motor housing 15, it is introduced into the cam-plate room 16. Therefore, a motor housing 15 can be more efficiently cooled with the refrigerant in the low-temperature condition of having not passed through the comparatively elevated temperature cam-plate room 16.

[0067] (The 5th operation gestalt: Refer to drawing 9) The points formed so that inhalation hole 31A which the electric cam-plate compressor of this operation gestalt did not form the branching free passage way 42 as compared with said 4th operation gestalt, but was prepared in the motor housing 11 might open between an external refrigerant circuit and the front regions of a motor housing 15 for free passage differ. Therefore, about the component which is common in the 4th operation gestalt, the explanation which attached the same sign and overlapped on the drawing is omitted.

[0068] The free passage way which opens inhalation hole 31A and an inhalatorium 31 for free passage is constituted from this operation gestalt by feed-hole 12B, free passage hole 12C, the cam-plate room 16, the free passage hole 41, and port 35G. Moreover, in addition to this free passage way and motor housing 15, the refrigerant path within a case is constituted by the inhalation hole 31A, inhalatorium 31, port 35A, 1st cylinder bore 13A, port 35B, intermediate pressure room 32, port 35C, and 2nd cylinder bore the 13B, port 35D, the regurgitation room 33, and discharge opening 33A.
[0069] The refrigerant inhaled by inhalation hole 31A from the external refrigerant circuit 50 is introduced into the front region of a motor housing 15. After the refrigerant introduced into this motor housing 15 passes through the clearance between a stator 19 and Rota 20, it is introduced into the cam-plate room 16 through free passage hole 12C and feed-hole 12B and thrust bearing 23. Then, the refrigerant in the cam-plate room 16 is introduced into an inhalatorium 31 through the free passage hole 41.
[0070] According to this operation gestalt, the following effectiveness can be acquired.
(14) Inhalation hole 31A was prepared in the motor housing 11, and after introducing the refrigerant from the external refrigerant circuit 50 into a motor housing 15 first, it has introduced into the cam-plate room 16. That is, without minding the cam-plate room 16, the refrigerant is directly introduced into the motor housing 15 as it is also at a very short path from the external refrigerant circuit 50. therefore -- until it results in a motor housing 15 -- completely -- ** -- a motor housing 15 can be more efficiently cooled with the low temperature refrigerant which does not have the opportunity by which temperature up is carried out, so that you may say.
[0071] The gestalt of operation is not limited above and can be carried out also by voice as follows.
O After not only a multistage type compressor but a refrigerant is inhaled by the compressor, you may apply to the single stage type compressor breathed out out of a compressor in response to a compression operation only at once. The thing of a type which discharges the refrigerant of the cam-plate interior of a room high-voltage-ized by blow-by gas to cam-plate outdoor by the pressure regulating valve as a single stage type compressor in this case, and adjusts the pressure of this cam-plate interior of a room is mentioned (JP,11-257219,A official report). Furthermore, the thing of not only a fixed capacity type given in said official report (JP,11-257219,A official report) but a variable-capacity type may be used. While constituting possible [modification of the inclination of a cam plate] as this variable-capacity type single-stage compressor, for example, a control valve is prepared in the path which opens an inhalatorium and a cam-plate room (crank case) for free passage, and what controls discharging volume by control of the cam-plate internal pressure force by closing motion of a control valve is mentioned. In the compressor of both [these] types, if a cam-plate room and a motor housing are made to open for free passage at a path and the refrigerant of the cam-plate interior of a room of an intermediate pressure condition [lower than a discharge pressure] higher than an inlet pressure is used, while being able to perform cooling within a compressor case efficiently, small lightweight-ization of this compressor can be attained.
[0072] O The configuration of said operation gestalt of the 4th and 5 may also be applied to a single stage type compressor.
O Ammonia other than a carbon dioxide etc. may be used as a refrigerant.
O With said each operation gestalt, although the cylinder bore etc. prepared 1 set of thing of a two-step type, it may be prepared 2 or more sets, for example. Moreover, it is good also as a multistage type more than a three-step type.
[0073] Next, technical thought other than invention indicated to the claim which can be grasped from said operation gestalt is indicated below with the effectiveness.
O In invention according to claim 1, said compressor has a pressure accommodation means is a single stage type compressor and discharge the high voltage refrigerant of said cam-plate interior of a room to this cam-plate outdoor by which a refrigerant is breathed out out of this compressor in response to a compression operation only at once after this compressor inhalation. In this case, with the refrigerant of an intermediate pressure condition [lower than a discharge pressure] higher than an inlet pressure, while being able to perform cooling within a compressor case efficiently, small lightweight-ization of

this compressor can be attained.
[0074] O Said free passage way is equipped with the free passage hole (for example, free passage hole 38 of drawing 1) which opens for free passage the free passage hole (for example, feed-hole 12B and free passage hole 12C of drawing 1) which opens said motor housing and said cam-plate room for free passage, and said cam-plate room and said intermediate pressure room in invention according to claim 2. in this case, a regurgitation refrigerant -- low temperature -- while being able to aim at the miniaturization and the improvement in endurance in a compressor case with a low voltage refrigerant, cooling with the sufficient effectiveness of a motor housing and a cam-plate room is possible.
[0075] O In invention according to claim 2, said free passage way leads the refrigerant of said intermediate pressure to said motor housing through said cam-plate room, and leads it to other cylinder bores and an intermediate pressure room open for free passage through said motor housing. In this case, a cam-plate room can be more efficiently cooled with the refrigerant of the low-temperature condition before passing a motor housing.
[0076] O In invention according to claim 2, it has a refrigerant cooling means to cool the refrigerant which passed through said motor housing and the cam-plate room. In this case, improvement in compression efficiency can be aimed at with the refrigerant with which it was low-temperature-ized by the refrigerant cooling means, and specific volume decreased.
[0077] O In invention according to claim 1, said free passage way opens an inhalatorium and a motor housing for free passage, and the inhalation hole with which the refrigerant from an external refrigerant circuit is inhaled is prepared in this motor housing. In this case, a motor housing can be more efficiently cooled with the refrigerant of a low-temperature condition with few opportunities by which temperature up will be carried out by the time it results that it is also at a very short path from an external refrigerant circuit in a motor housing.
[0078]
[Effect of the Invention] As explained in full detail above, according to this invention according to claim 1 to 5, small lightweight-ization of a compressor is enabled and the inside of this compressor can be cooled efficiently.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the electric cam-plate compressor used for example, for the air conditioner for cars.

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PRIOR ART

[Description of the Prior Art] The electrically-driven compressor is known as a compressor built into the refrigerant circulator of heat exchange equipments, such as an air conditioner for cars. Generally the electrically-driven compressor is equipped with the refrigerant compressor style driven by the electric motor and this motor in the case used as that coat. This refrigerant compressor style consists of a piston held in the cylinder bore in a compressor possible [reciprocation], a cam plate which is formed in the cam-plate room by which partition formation was carried out into the compressor, and changes rotation of said motor into the reciprocating motion of this piston. Since this motor is expected the rotational capacity which realizes a high revolution, and the driving force which can bear high load torque, said compressor needs to be equipped with a high power motor. However, in the configuration of opposing a high revolution load as it is also with a high power motor, it will be urged to high generation-of-heat-ization of a motor and ambient temperature lifting of this motor will be promoted further. Though this ambient temperature lifting is natural, in order to make this motor itself into an elevated temperature, a risk called decline in the revolution effectiveness which the demagnetization of a motor own [by this elevated-temperature-izing / this] causes hangs around. Therefore, motor cooling for avoiding elevated-temperature-ization of this motor is needed.
[0003] Moreover, if the high-speed revolution of said cam plate is carried out, since it will be in a high temperature condition by the sliding friction with the shoe infixed between said pistons, from the field of endurance or sliding stability, cooling of this cam plate is also combined and is needed.
[0004] The thing of introducing the refrigerant in a compressor into the motor housing equipped with this motor as a configuration for said motor cooling is known (JP,7-133779,A). This configuration introduces into said motor housing the regurgitation refrigerant in the condition of it being breathed out from said refrigerant compressor style, and being sent to the equipment (for example, condenser) of the external downstream of said compressor, and performed motor cooling.
[0005] Moreover, what introduces into said motor housing the inhalation refrigerant inhaled by this compressor from the equipment (for example, evaporator) of the external upstream of said compressor, and performs motor cooling to JP,9-236092,A is indicated.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained in full detail above, according to this invention according to claim 1 to 5, small lightweight-ization of a compressor is enabled and the inside of this compressor can be cooled efficiently.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, with the former configuration, when the regurgitation refrigerant used for cooling of a motor is made a high-pressure and elevated temperature condition by compression by said refrigerant compressor style and the refrigerant of such a condition is used for said motor cooling, the following two technical problems are induced.
[0007] Small lightweight-ization of said case will be obstructed by using a high voltage regurgitation refrigerant for the 1st first. That is, a rise on the strength, i.e., the thick increment in a case, duplication, thick buildup of the reinforcement member inside a case, etc., for said motor housing to be a field where the rate of a capacity factor is comparatively big, and bear said case in a compressor, at the high voltage condition is needed.
[0008] Since the refrigerant itself used [2nd] for cooling is an elevated temperature, said motor cooling becomes an inefficient thing. on the other hand, only installation of the refrigerant to said motor housing is indicated for both configuration -- **** -- it does not pass and disclosure about cooling of said cam plate is not performed. That is, the actual condition is that the response over overheating of a cam plate is not taken into consideration.
[0009] The object of this invention enables small lightweight-ization of an airframe, and is to offer the electric cam-plate compressor which can cool a motor housing and a cam-plate room efficiently.

[Translation done.]

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MEANS

[Means for Solving the Problem] In order to solve the above-mentioned trouble, invention according to claim 1 The motor housing, cam-plate room and cylinder bore which were formed in the case, and the piston which performs a compression operation while holding possible [reciprocation] in said cylinder bore, While being supported pivotable in said case in the condition of having been inserted in said motor housing and the cam-plate room and connecting with the electric motor of this motor interior of a room In the electric cam-plate compressor equipped with the driving shaft which carries out both-way actuation of said piston by actuation of said motor through the cam plate arranged in said cam-plate interior of a room While the free passage way which opens for free passage the parts and said motor housings other than the regurgitation room opened for free passage by the external refrigerant circuit among the refrigerant paths within a case of said compressor is prepared, let it be a summary to include said cam-plate room on this free passage way.
[0011] According to this invention, the motor housing and cam-plate room of an electric cam-plate compressor are that the refrigerant within the refrigerant path within a case is introduced through a free passage way, and both the interior of a room is cooled. the refrigerant, i.e., the regurgitation refrigerant, of the regurgitation interior of a room where the refrigerant introduced into both the interior of a room is opened for free passage by the external refrigerant circuit -- low temperature -- since it is in a low voltage condition, as compared with the configuration which uses a regurgitation refrigerant for cooling, whenever [both room air temperature], and a pressure will be fallen more That is, while raising cooling effectiveness, reduction of the pressure resistance of a case is enabled.
[0012] Invention according to claim 2 is the multistage type compressor equipped with the 1st cylinder bore into which said compressor inhales and compresses the inhalation refrigerant from an external refrigerant circuit, and other cylinder bores which inhale the refrigerant of the intermediate pressure compressed once [at least], and are compressed in invention according to claim 1, and said free passage way makes it a summary to open for free passage the intermediate pressure room where the refrigerant of said intermediate pressure exists, and said motor housing.
[0013] According to this invention, said motor housing and a cam-plate room are cooled with the intermediate pressure refrigerant breathed out by the intermediate pressure room of a multistage type compressor. Since an intermediate pressure refrigerant is fully low-temperature low voltage, it is more suitable than said regurgitation refrigerant for reduction of the improvement in cooling effectiveness, and case pressure resistance.
[0014] After said motor housing is arranged for invention according to claim 3 in invention according to claim 1 or 2 at the upstream rather than said cam-plate room in said free passage way and some refrigerants [at least] pass this motor housing, let it be a summary to pass through this cam-plate room.
[0015] According to this invention, before said cam-plate room is cooled, said motor housing is cooled. That is, since this motor housing is cooled with the low temperature refrigerant which has not carried out a temperature rise at least in this cam-plate interior of a room, the cooling effectiveness of this motor housing improves further.
[0016] Invention according to claim 4 makes it a summary for said free passage way to open either and

said motor housing for free passage at least among the inhalation holes which introduce into this inhalatorium the inhalatorium and this inhalation refrigerant with which the inhalation refrigerant from said external refrigerant circuit exists in invention according to claim 1.
[0017] According to this invention, the inhalation refrigerant from said external refrigerant circuit is introduced into said motor housing and a cam-plate room. This inhalation refrigerant is low-temperature low voltage more nearly further than said intermediate pressure refrigerant. Therefore, for reduction of the improvement in cooling effectiveness, and case pressure resistance, it can be said that it is still more suitable.
[0018] While invention according to claim 5 has the branching free passage way by which the branching was carried out from said inhalatorium or the inhalation hole in invention according to claim 4 and this branching free passage way constitutes the refrigerant path within a case of said compressor, let it be a summary to be arranged at the upstream of said motor housing and a cam-plate room.
[0019] According to this invention, said inhalation refrigerant is introduced into said motor housing and a cam-plate room through a branching free passage way. Although these some inhalation refrigerants are introduced into both ** in that case, a part is inhaled by the cylinder bore, without being introduced into both **. Therefore, since the inhalation refrigerant elevated-temperature-ized in both the interior of a room is only only the part, the temperature of the refrigerant inhaled in said cylinder bore does not rise comparatively. That is, decline in the compression efficiency which buildup of the specific volume accompanying the temperature rise of the refrigerant inhaled by this cylinder bore causes is suppressed.
[0020]
[Embodiment of the Invention] (1st operation gestalt) The 1st operation gestalt materialized to the multistage-type electric cam-plate compressor which uses a carbon dioxide by using this invention as a refrigerant hereafter is explained according to drawing 1 and drawing 2 . In addition, make the left of drawing 1 into the front of a compressor, and let the method of the right be back.
[0021] As shown in drawing 1 , the electric cam-plate compressor is equipped with the motor housing 11, the front housing 12, a cylinder block 13, and the rear housing 14. Each [these] housing 11, 12, and 14 and a cylinder block 13 constitute the case of this compressor in which junction immobilization was mutually carried out by two or more through bolts which are not illustrated and that carried out the shape of a cylindrical shape mostly. In the field where the motor housing 15 was surrounded by the front housing 12 and the cylinder block 13 in the field surrounded by the motor housing 11 and the front housing 12, partition formation of the cam-plate room 16 is carried out, respectively.
[0022] Between the motor housing 11 and a cylinder block 13, the driving shaft 17 inserted in the motor housing 15 and the cam-plate room 16 is supported pivotable through the radial bearings 18A and 18B of an order couple. The driving shaft 17 has fitted in loosely feed-hole 12B of wall 12A formed in the front housing 12.
[0023] The electric motor 21 which consists of a stator 19 and Rota 20 really fixed pivotable on the driving shaft 17 is held by the motor housing 15. At the cam-plate room 16, on a driving shaft 17, the cam plate 22 of a disc configuration is really fixed pivotable, and thrust bearing 23 is arranged between a cam plate 22 and wall 12A. The driving shaft 17 and cam plate 22 which were unified are positioned in the thrust direction (the direction of a driving shaft axis) by the washer 25 by which front energization was carried out with the spring 24 arranged in the hold crevice formed in the center of a cylinder block 13, and thrust bearing 23.
[0024] It is formed in the location where 2nd cylinder bore 13B as other cylinder bores formed in the minor diameter counters a cylinder block 13 on both sides of a driving shaft 17 mutually rather than 1st cylinder bore 13A and this cylinder bore 13A. The 1st and 2nd pistons 26 and 27 of a piece head form are held in the cross direction by each cylinder bores 13A and 13B possible [both-way sliding], respectively, and the compression space 13E and 13F which carries out a volume change according to both-way sliding of each pistons 26 and 27 is divided in each boa 13A and 13B, respectively. Crevices 26A and 27A are established in the front section of each pistons 26 and 27, respectively, and the shoes 28 and 29 of a couple are held in these crevices 26A and 27A. When the periphery section of a cam plate 22 is pinched by both the shoes 28 and 29 possible [sliding], actuation connection of each pistons 26

and 27 is carried out at the cam plate 22. For this reason, with a revolution of the driving shaft 17 by said electric motor 21, rotation of a cam plate 22 is changed into a both-way rectilinear motion of each pistons 26 and 27 in the stroke corresponding to whenever [that tilt-angle] because a cam plate 22 carries out a synchronous revolution with this driving shaft 17.

[0025] Between a cylinder block 13 and the rear housing 14, the valve organizer 30 is inserted into both, and is made and prepared. As shown in drawing 1 and drawing 2 , between the valve organizer 30 and the rear housing 14, the inhalatorium 31 where the inhalation refrigerant from the external refrigerant circuit 50 is introduced through inhalation hole 31A prepared in the peripheral wall of the rear housing 14 is formed. Furthermore, partition formation of the intermediate pressure room 32 which connects each cylinder bore 13A and 13B, and the regurgitation room 33 opened for free passage by the external refrigerant circuit 50 through discharge opening 33A prepared in the posterior wall of stomach of the rear housing 14 is carried out.

[0026] The valve organizer 30 becomes the suction valve portion formation member 34, the port formation member 35, the 1st and 2nd discharge valves 36A and 36B, 1st and 2nd retainer 37A, and 37B list from Pins 30A and 30C.

[0027] Ports 35A, 35B, 35C, 35D, and 35E are formed in the port formation member 35. Port 35A makes an inhalatorium 31 and 1st cylinder bore 13A open for free passage, and port 35B makes 1st cylinder bore 13A and the intermediate pressure room 32 open for free passage. Moreover, port 35C makes 2nd cylinder bore 13B and the intermediate pressure room 32 open for free passage, and port 35D makes 2nd cylinder bore 13B and the regurgitation room 33 open for free passage. Furthermore, port 35E makes the intermediate pressure room 32 and the cam-plate room 16 open for free passage through the free passage hole 38 mentioned later.

[0028] Moreover, the suction valve portion is formed in the location adjusted in the suction valve portion formation member 34 in Ports 35A and 35C. Furthermore, in the intermediate pressure room 32, discharge valve 36A and retainer 37A are being fixed to the suction valve portion formation member 34 and the port formation member 35 by pin 30A. Moreover, as shown in drawing 2 , in the regurgitation room 33, discharge valve 36B and retainer 37B are being fixed to both the formation members 34 and 35 by pin 30C.

[0029] In addition, the refrigerant path within a case is constituted by the inhalation hole 31A, inhalatorium 31, port 35A, 1st cylinder bore 13A, port 35B, intermediate pressure room 32, port 35C, and 2nd cylinder bore the 13B, port 35D, the regurgitation room 33, and discharge opening 33A.

[0030] The free passage hole 38 which makes the intermediate pressure room 32 and the cam-plate room 16 open for free passage is formed in the cylinder block 13. Moreover, free passage hole 12C which makes the cam-plate room 16 and a motor housing 15 open for free passage is formed in wall 12A of the front housing 12. The free passage way which opens the intermediate pressure room 32 and a motor housing 15 for free passage by feed-hole 12B of the free passage hole 38, the cam-plate room 16, and the front housing 12 and free passage hole 12C is constituted.

[0031] Next, an operation of the compressor constituted as mentioned above is explained. If a driving shaft 17 rotates with an electric motor 21, a cam plate 22 will rotate to one. Both-way actuation of each pistons 26 and 27 is carried out through shoes 28 and 29 with a revolution of a cam plate 22, respectively. In each compression space 13E and 13F, inhalation of a refrigerant, compression, and the regurgitation are successively repeated by continuation of this actuation.

[0032] If the refrigerant from inhalation hole 31A to an inhalatorium 31 is inhaled by compression space 13E through port 35A, the intermediate pressure room 32 will breathe out the compression operation by the setback of the 1st piston 26 through port 35B after a carrier beam.

[0033] Furthermore, some refrigerants in this intermediate pressure room 32 are inhaled by compression space 13F through port 35C, and it is breathed out by the regurgitation room 33 through port 35D after the compression operation by migration of the 2nd piston 27. The refrigerant breathed out by the regurgitation room 33 is sent out to the external refrigerant circuit 50 from discharge opening 33A.

[0034] On the other hand, although not inhaled by compression space 13F among the refrigerants in the above-mentioned intermediate pressure room 32, at least a part passes port 35E and the free passage

hole 38, and is supplied to the cam-plate room 16. Furthermore, a motor housing 15 is supplied from the cam-plate room 16 through feed-hole 12B of thrust bearing 23 and the front housing 12, and free passage hole 12C. Supply of a refrigerant in this motor housing 15 or the cam-plate room 16 is effectively performed by Rota 20 accompanying a revolution of an electric motor 21, and stirring by revolution of a cam plate 22. And an electric motor 21 is cooled with the refrigerant supplied to the motor housing 15, and a cam plate 22 and a shoe 28, and 29 grades are cooled with the refrigerant supplied to the cam-plate room 16.

[0035] Moreover, the refrigerant in the intermediate pressure room 32 is fully low temperature as compared with the refrigerant in the regurgitation room 33 which is only a carrier beam and was compressed within both said two compression space 13E and 13F in the compression operation within compression space 13E, and low voltage cannot be overemphasized.

[0036] According to this operation gestalt, the following effectiveness can be acquired.

(1) For cooling of a motor housing 15 and the cam-plate room 16, the refrigerant in the sufficiently low voltage intermediate pressure room 32 is introduced rather than the regurgitation room 33. Therefore, it becomes possible to set up low the pressure resistance of this case of a part that does not expose the inside of a motor housing 15 and the cam-plate room 16 to the pressure as the refrigerant pressure force in the regurgitation room 33, and corresponds with a motor housing 15 and the cam-plate room 16. Therefore, the miniaturization and the improvement in endurance in a case can be aimed at. Moreover, rather than the thing in the regurgitation room 33, since the refrigerant in the intermediate pressure room 32 is low temperature enough, it can cool a motor housing 15 efficiently. Consequently, also when high-speed operation is performed or a heavy load is applied to a motor 21, demagnetization of this motor 21 is prevented.

[0037] (2) The refrigerant in the intermediate pressure room 32 is introduced not only into the motor housing 15 but into the cam-plate room 16. That is, the large area within a compressor case is covered and cooling within this case is performed. Therefore, when a heavy load is applied to a high speed driving time or a motor 21, overheating of the shoes 28 and 29 can be prevented.

[0038] (3) Moreover, the installation to the cam-plate room 16 of the refrigerant in the intermediate pressure room 32 enables efficient cooling of bearings 18B and 23, a cam plate 22, shoes 28 and 29, pistons 26 and 27, and a lubricating oil (contained in the state of Myst in a carbon dioxide). That is, degradation by degradation of the lubricating oil by sliding of each part material (bearings 18B and 23, a cam plate 22, shoes 28 and 29, and pistons 26 and 27) in an elevated temperature condition and elevated-temperature-izing of the lubricating oil itself can be suppressed.

[0039] Furthermore, the pressure in the cam-plate room 16 turns into the same intermediate pressure as the pressure in the intermediate pressure room 32 by installation to the cam-plate room 16 of the refrigerant in the intermediate pressure room 32. That is, the pressure which acts on a before [the 1st piston 26] side, and the pressure which acts on the backside [this piston 26] at the time of the regurgitation of compression space 13E will be in an almost equal condition. Moreover, the pressure differential of the pressure which acts on a before [the 2nd piston 27] side, and the pressure which acts on the backside [this piston 27] at the time of the regurgitation of compression space 13F also becomes small compared with the former. That is, since the pressure differential before each pistons 26 and 27 when being in the regurgitation process to which the load load concerning each pistons 26 and 27 becomes the largest, and on the backside decreases, the force of acting on a cam plate 22, shoes 28 and 29, and pistons 26 and 27 becomes small. Therefore, degradation of the lubricating oil by sliding [heavy load / between each part material (a cam plate 22, shoes 28 and 29, and pistons 26 and 27)] can be suppressed.

[0040] (4) The refrigerant in the intermediate pressure room 32 is already a carrier beam refrigerant about a compression operation in compression space 13E, and is an elevated temperature from the refrigerant in an inhalatorium 31. Therefore, there are few degrees of a refrigerant temperature rise as compared with the configuration using the refrigerant introduced from the inhalatorium 31 with the configuration of the above-mentioned operation gestalt which cools a motor housing 15 using the introduced refrigerant from the intermediate pressure room 32. That is, it is hard to be influenced of the

compression efficiency lowering by the increment in specific volume of a refrigerant.
[0041] (The 2nd operation gestalt: Refer to drawing 3 and drawing 4) The electric cam-plate compressor of this 2nd operation gestalt changes the configuration of the refrigerant path within a case, and a free passage way in said 1st operation gestalt, and has the same composition as the electric cam-plate compressor of the 1st operation gestalt in respect of others. Therefore, about the component which is common in the 1st operation gestalt, the explanation which attached the same sign and overlapped on the drawing is omitted.
[0042] Between the valve organizer 30 and the rear housing 14, partition formation of the two intermediate pressure rooms 32A and 32B other than an inhalatorium 31 and the regurgitation room 33 is carried out. 1st intermediate pressure room 32A is opened for free passage by port 35B and hole 30B mentioned later, and 2nd intermediate pressure room 32B is opened for free passage by Ports 35C and 35E.
[0043] Hole 30B which penetrates pin 30A to shaft orientations is formed in pin 30A. Cylinder block feed-hole 13C which opens for free passage the hold crevice in which the back end section of a driving shaft 17 is held, and hole 30B is formed in the cylinder block 13. Driving shaft free passage hole 17A which opens the front region in a motor housing 15 and cylinder block feed-hole 13C for free passage is formed in the driving shaft 17. Moreover, the free passage hole 38 which makes the cam-plate room 16 and port 35E always open for free passage is formed in the cylinder block 13. Therefore, the free passage way which always opens between both intermediate pressure room 32A and 32B for free passage through a motor housing 15 is constituted by each holes 30B, 13C, 17A, 12B, 12C, and 38, port 35E, and the cam-plate room 16.
[0044] In addition, in addition to this free passage way and motor housing 15, the refrigerant path within a case is constituted by the inhalation hole 31A, inhalatorium 31, port 35A, 1st cylinder bore 13A, port 35B, 1st and 2nd intermediate pressure roomA [32] and 32B, port 35C, and 2nd cylinder bore the 13B, port 35D, the regurgitation room 33, and discharge opening 33A.
[0045] The refrigerant which was inhaled by 1st cylinder bore 13A and compressed into it from the inhalatorium 31 is breathed out by 1st intermediate pressure room 32A through port 35B. And the refrigerant in this 1st intermediate pressure room 32A is introduced into the front region in a motor housing 15 through hole 30B, cylinder block feed-hole 13C, and driving shaft free passage hole 17A. Furthermore, after the refrigerant introduced in this motor housing 15 passes through the clearance between a stator 19 and Rota 20, it is introduced into the cam-plate room 16 through free passage hole 12C and feed-hole 12B and thrust bearing 23. Then, the refrigerant in the cam-plate room 16 is introduced into 2nd intermediate pressure room 32B through the free passage hole 38.
[0046] After the refrigerant in 2nd intermediate pressure room 32B is inhaled by 2nd cylinder bore 13B through port 35C, it is further compressed by the 2nd piston 27 and is breathed out by the external refrigerant circuit through port 35D, the regurgitation room 33, and discharge opening 33A.
[0047] According to this operation gestalt, the following effectiveness other than the effectiveness of (1) - (4) of said operation gestalt can be acquired.
(5) A motor housing 15 and the cam-plate room 16 are included in the only refrigerant path within a case in which it does not have other bypass paths, and it was made for a refrigerant to pass through the inside of both ** 15 and 16 compulsorily. Therefore, as compared with said operation gestalt, the cooling effect in both ** 15 and 16 improves.
[0048] (6) After introducing first the refrigerant in 1st intermediate pressure room 32A into a motor housing 15, it is introduced into the cam-plate room 16. That is, the refrigerant in 1st intermediate pressure room 32A is directly introduced into the motor housing 15 from this intermediate pressure room 32A, without minding the cam-plate room 16. Therefore, a motor housing 15 can be more efficiently cooled with the refrigerant of the low-temperature condition before passing through the cam-plate room 16.
[0049] (7) It is constituted so that the refrigerant introduced into the front region of a motor housing 15 may pass to the back region of a motor housing 15 through the clearance between a stator 19 and Rota 20. That is, a refrigerant cools the large area of the front face of an electric motor 21. Thereby, an

electric motor 21 can be cooled efficiently.
[0050] (The 3rd operation gestalt: Refer to drawing 5 and drawing 6) The electric cam-plate compressor of this operation gestalt changes the configuration of the refrigerant path within a case, and a free passage way in said 2nd operation gestalt, and has the same composition as the electric cam-plate compressor of the 2nd operation gestalt in respect of others. Therefore, about the component which is common in the 2nd operation gestalt, the explanation which attached the same sign and overlapped on the drawing is omitted.
[0051] As shown in drawing 6 , extension formation of the 2nd intermediate pressure room 32B is carried out to near the periphery section of the rear housing 14. The free passage hole 40 is formed in a driving shaft 17 and parallel at the peripheral face top of a compressor case (drawing 6 rear housing 14) in the heights 39 as a refrigerant cooling means by which swelling formation was carried out. A motor housing 15 and intermediate pressure room 32B are opened for free passage through the free passage hole 40 and port 35F.
[0052] The motor housing 11, the front housing 12, and a cylinder block 13 are covered, penetration formation is carried out, and the free passage hole 40 is always opening the front region in port 35 F and a motor housing 15 for free passage.
[0053] Penetration formation of the cylinder block free passage hole 13D which opens the cam-plate room 16 and hole 30B for free passage is carried out at the cylinder block 13. Therefore, the free passage way which always opens between both intermediate pressure room 32A and 32B for free passage through a motor housing 15 is constituted by each holes 30B, 13D, 12B, 12C, and 40, port 35F, and the cam-plate room 16.
[0054] In addition, in addition to this free passage way and motor housing 15, the refrigerant path within a case is constituted by the inhalation hole 31A, inhalatorium 31, port 35A, 1st cylinder bore 13A, port 35B, 1st and 2nd intermediate pressure roomA [32] and 32B, port 35C, and 2nd cylinder bore the 13B, port 35D, the regurgitation room 33, and discharge opening 33A.
[0055] With this operation gestalt, the intermediate pressure refrigerant in 1st intermediate pressure room 32A is introduced into the cam-plate room 16 through hole 30B and cylinder block free passage hole 13D. The refrigerant in the cam-plate room 16 is introduced into the back region in a motor housing 15 through free passage hole 12C of the front housing 12, feed-hole 12B, and thrust bearing 23. After the refrigerant introduced into this motor housing 15 passes through the clearance between a stator 19 and Rota 20, it is introduced in opening of the free passage hole 40 formed in the front region in a motor housing 15, and is introduced into 2nd intermediate pressure room 32B through the free passage hole 40 and port 35F. After the refrigerant in 2nd intermediate pressure room 32B is inhaled by compression space 13F through port 35C, it is further compressed by the 2nd piston 27 and is breathed out by the external refrigerant circuit through port 35D, the regurgitation room 33, and discharge opening 33A.
[0056] According to this operation gestalt, the following effectiveness other than the effectiveness of aforementioned (1) - (5) can be acquired.
(8) After introducing first the refrigerant in 1st intermediate pressure room 32A into the cam-plate room 16, it is introduced into the motor housing 15. That is, the refrigerant in 1st intermediate pressure room 32A is directly introduced into the cam-plate room 16 from this intermediate pressure room 32A, without minding a motor housing 15. Therefore, the cam-plate room 16 can be more efficiently cooled with the refrigerant of the low-temperature condition before passing a motor housing 15.
[0057] (9) The refrigerant which passed through the 1st cam-plate room 16 from intermediate pressure room 32A and motor housing 15 passes the free passage hole 40, and it was made to result in 2nd intermediate pressure room 32B. Since this free passage hole 40 is formed in the heights which projected further from the periphery section of a compressor case, it tends to miss the heat in the free passage hole 40 to the compressor exterior. Therefore, the refrigerant which passes this free passage hole 40 will result in 2nd intermediate pressure room 32B, after being cooled. That is, since the refrigerant with which it was low-temperature-ized and specific volume decreased is inhaled by 2nd cylinder bore 13B, improvement in compression efficiency can be aimed at.
[0058] (The 4th operation gestalt: Refer to drawing 7 and drawing 8) The electric cam-plate compressor

of this operation gestalt changes the configuration of the refrigerant path within a case, and a free passage way in said 1st operation gestalt, and has the same composition as the electric cam-plate compressor of the 1st operation gestalt in respect of others. Therefore, about the component which is common in the 1st operation gestalt, the explanation which attached the same sign and overlapped on the drawing is omitted.

[0059] Port 35G are always which makes a cylinder block 13 open an inhalatorium 31 and the cam-plate room 16 for free passage with the free passage hole 41 by which penetration formation was carried out a free passage port among each ports 35A, 35B, 35C, 35D, and 35G currently formed in the port formation member 35.

[0060] Moreover, the front region of a motor housing 15 is this inhalation hole 31A and always open for free passage with the branching free passage way 42 by which the branching was carried out from inhalation hole 31A. The branching free passage way 42 covers the motor housing 11, the front housing 12, a cylinder block 13, and the rear housing 14, and penetration formation is carried out between a motor housing 15 and inhalation hole 31A.

[0061] In addition, the free passage way which always opens inhalation hole 31A and an inhalatorium 31 for free passage through a motor housing 15 is constituted by the branching free passage way 42, Holes 12B and 12C, the cam-plate room 16, the free passage hole 41, and port 35G. Moreover, a part of refrigerant path within a case is constituted by this free passage way and motor housing 15.

[0062] Some refrigerants inhaled by inhalation hole 31A from the external refrigerant circuit 50 pass inhalation hole 31A as it is, it reaches an inhalatorium 31, and other refrigerants are introduced into the branching free passage way 42, and reach the front region of a motor housing 15. After the refrigerant introduced into this motor housing 15 passes through the clearance between a stator 19 and Rota 20, it is introduced into the cam-plate room 16 through free passage hole 12C and feed-hole 12B and thrust bearing 23. Then, the refrigerant in the cam-plate room 16 is introduced into an inhalatorium 31 through the free passage hole 41.

[0063] According to this operation gestalt, the following effectiveness can be acquired.

(10) The inhalation refrigerant before being compressed is introduced into the motor housing 15 and the cam-plate room 16. That is, the refrigerant of the low-temperature condition before carrying out a temperature rise according to a compression operation is used. Therefore, a motor housing 15 and the cam-plate room 16 can be cooled more.

[0064] (11) Form the branching free passage way 42 by which the branching was carried out from inhalation hole 31A, some inhalation refrigerants from the external refrigerant circuit 50 are made to go via a motor housing 15 and the cam-plate room 16, and an inhalatorium 31 and the remainder were introduced to the direct inhalatorium 31. That is, the refrigerant by which temperature up is carried out within both ** 15 and 16 is used as some inhalation refrigerants from the external refrigerant circuit 50, and the temperature up of the remaining inhalation refrigerants was made not to be carried out. Therefore, since the temperature rise of the refrigerant inhaled by compression space 13E is suppressed, decline in the compression efficiency by the increment in the specific volume of a refrigerant can be suppressed.

[0065] (12) In a motor housing 15 and the cam-plate room 16, the sufficiently low voltage inlet-pressure refrigerant is introduced rather than the refrigerant breathed out by the regurgitation room 33 and also the intermediate pressure room 32. Therefore, the miniaturization and the improvement in endurance in a compressor case can be aimed at.

[0066] (13) After introducing first the refrigerant from the branching free passage way 42 into a motor housing 15, it is introduced into the cam-plate room 16. Therefore, a motor housing 15 can be more efficiently cooled with the refrigerant in the low-temperature condition of having not passed through the comparatively elevated temperature cam-plate room 16.

[0067] (The 5th operation gestalt: Refer to drawing 9) The points formed so that inhalation hole 31A which the electric cam-plate compressor of this operation gestalt did not form the branching free passage way 42 as compared with said 4th operation gestalt, but was prepared in the motor housing 11 might open between an external refrigerant circuit and the front regions of a motor housing 15 for free passage

differ. Therefore, about the component which is common in the 4th operation gestalt, the explanation which attached the same sign and overlapped on the drawing is omitted.
[0068] The free passage way which opens inhalation hole 31A and an inhalatorium 31 for free passage is constituted from this operation gestalt by feed-hole 12B, free passage hole 12C, the cam-plate room 16, the free passage hole 41, and port 35G. Moreover, in addition to this free passage way and motor housing 15, the refrigerant path within a case is constituted by the inhalation hole 31A, inhalatorium 31, port 35A, 1st cylinder bore 13A, port 35B, intermediate pressure room 32, port 35C, and 2nd cylinder bore the 13B, port 35D, the regurgitation room 33, and discharge opening 33A.
[0069] The refrigerant inhaled by inhalation hole 31A from the external refrigerant circuit 50 is introduced into the front region of a motor housing 15. After the refrigerant introduced into this motor housing 15 passes through the clearance between a stator 19 and Rota 20, it is introduced into the cam-plate room 16 through free passage hole 12C and feed-hole 12B and thrust bearing 23. Then, the refrigerant in the cam-plate room 16 is introduced into an inhalatorium 31 through the free passage hole 41.
[0070] According to this operation gestalt, the following effectiveness can be acquired.
(14) Inhalation hole 31A was prepared in the motor housing 11, and after introducing the refrigerant from the external refrigerant circuit 50 into a motor housing 15 first, it has introduced into the cam-plate room 16. That is, without minding the cam-plate room 16, the refrigerant is directly introduced into the motor housing 15 as it is also at a very short path from the external refrigerant circuit 50. therefore -- until it results in a motor housing 15 -- completely -- ** -- a motor housing 15 can be more efficiently cooled with the low temperature refrigerant which does not have the opportunity by which temperature up is carried out, so that you may say.
[0071] The gestalt of operation is not limited above and can be carried out also by voice as follows.
O After not only a multistage type compressor but a refrigerant is inhaled by the compressor, you may apply to the single stage type compressor breathed out out of a compressor in response to a compression operation only at once. The thing of a type which discharges the refrigerant of the cam-plate interior of a room high-voltage-ized by blow-by gas to cam-plate outdoor by the pressure regulating valve as a single stage type compressor in this case, and adjusts the pressure of this cam-plate interior of a room is mentioned (JP,11-257219,A official report). Furthermore, the thing of not only a fixed capacity type given in said official report (JP,11-257219,A official report) but a variable-capacity type may be used. While constituting possible [modification of the inclination of a cam plate] as this variable-capacity type single-stage compressor, for example, a control valve is prepared in the path which opens an inhalatorium and a cam-plate room (crank case) for free passage, and what controls discharging volume by control of the cam-plate internal pressure force by closing motion of a control valve is mentioned. In the compressor of both [these] types, if a cam-plate room and a motor housing are made to open for free passage at a path and the refrigerant of the cam-plate interior of a room of an intermediate pressure condition [lower than a discharge pressure] higher than an inlet pressure is used, while being able to perform cooling within a compressor case efficiently, small lightweight-ization of this compressor can be attained.
[0072] O The configuration of said operation gestalt of the 4th and 5 may also be applied to a single stage type compressor.
O Ammonia other than a carbon dioxide etc. may be used as a refrigerant.
O With said each operation gestalt, although the cylinder bore etc. prepared 1 set of thing of a two-step type, it may be prepared 2 or more sets, for example. Moreover, it is good also as a multistage type more than a three-step type.
[0073] Next, technical thought other than invention indicated to the claim which can be grasped from said operation gestalt is indicated below with the effectiveness.
O In invention according to claim 1, said compressor has a pressure accommodation means is a single stage type compressor and discharge the high voltage refrigerant of said cam-plate interior of a room to this cam-plate outdoor by which a refrigerant is breathed out out of this compressor in response to a compression operation only at once after this compressor inhalation. In this case, with the refrigerant of

an intermediate pressure condition [lower than a discharge pressure] higher than an inlet pressure, while being able to perform cooling within a compressor case efficiently, small lightweight-ization of this compressor can be attained.

[0074] O Said free passage way is equipped with the free passage hole (for example, free passage hole 38 of drawing 1) which opens for free passage the free passage hole (for example, feed-hole 12B and free passage hole 12C of drawing 1) which opens said motor housing and said cam-plate room for free passage, and said cam-plate room and said intermediate pressure room in invention according to claim 2. in this case, a regurgitation refrigerant -- low temperature -- while being able to aim at the miniaturization and the improvement in endurance in a compressor case with a low voltage refrigerant, cooling with the sufficient effectiveness of a motor housing and a cam-plate room is possible.

[0075] O In invention according to claim 2, said free passage way leads the refrigerant of said intermediate pressure to said motor housing through said cam-plate room, and leads it to other cylinder bores and an intermediate pressure room open for free passage through said motor housing. In this case, a cam-plate room can be more efficiently cooled with the refrigerant of the low-temperature condition before passing a motor housing.

[0076] O In invention according to claim 2, it has a refrigerant cooling means to cool the refrigerant which passed through said motor housing and the cam-plate room. In this case, improvement in compression efficiency can be aimed at with the refrigerant with which it was low-temperature-ized by the refrigerant cooling means, and specific volume decreased.

[0077] O In invention according to claim 1, said free passage way opens an inhalatorium and a motor housing for free passage, and the inhalation hole with which the refrigerant from an external refrigerant circuit is inhaled is prepared in this motor housing. In this case, a motor housing can be more efficiently cooled with the refrigerant of a low-temperature condition with few opportunities by which temperature up will be carried out by the time it results that it is also at a very short path from an external refrigerant circuit in a motor housing.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view showing the outline of the electric cam-plate compressor of the 1st operation gestalt.
[Drawing 2] The 2-2 line sectional view of drawing 1 .
[Drawing 3] The 3-3 line sectional view of drawing 4 .
[Drawing 4] The sectional view showing the outline of the electric cam-plate compressor of the 2nd operation gestalt.
[Drawing 5] The sectional view showing the outline of the electric cam-plate compressor of the 3rd operation gestalt.
[Drawing 6] The 6-6 line sectional view of drawing 5 .
[Drawing 7] The 7-7 line sectional view of drawing 8 .
[Drawing 8] The sectional view showing the outline of the electric cam-plate compressor of the 4th operation gestalt.
[Drawing 9] The sectional view showing the outline of the electric cam-plate compressor of the 5th operation gestalt.
[Description of Notations]
11 -- Motor housing, 12 -- Front housing, 13 -- Cylinder block, 13A -- The 1st cylinder bore, 13B -- The 2nd cylinder bore, 13C -- Cylinder block feed hole, 13D -- Cylinder block free passage hole (13C and 13D constitute a free passage way), 14 -- Rear housing (11, 12, 13, and 14 constitute a compressor case), 15 [-- The driving shaft free passage hole which constitutes a free passage way,] -- A motor housing, 16 -- A cam-plate room, 17 -- A driving shaft, 17A 21 [-- The 2nd piston, 31 / -- An inhalatorium, 32 / -- An intermediate pressure room, 32A / -- The 1st intermediate pressure room, 32B / -- The 2nd intermediate pressure room, 33 / -- A regurgitation room, 38 40, 41 / -- The free passage hole, 42 which constitute a free passage way / -- Branching free passage way.] -- An electric motor, 22 -- A cam plate, 26 -- The 1st piston, 27

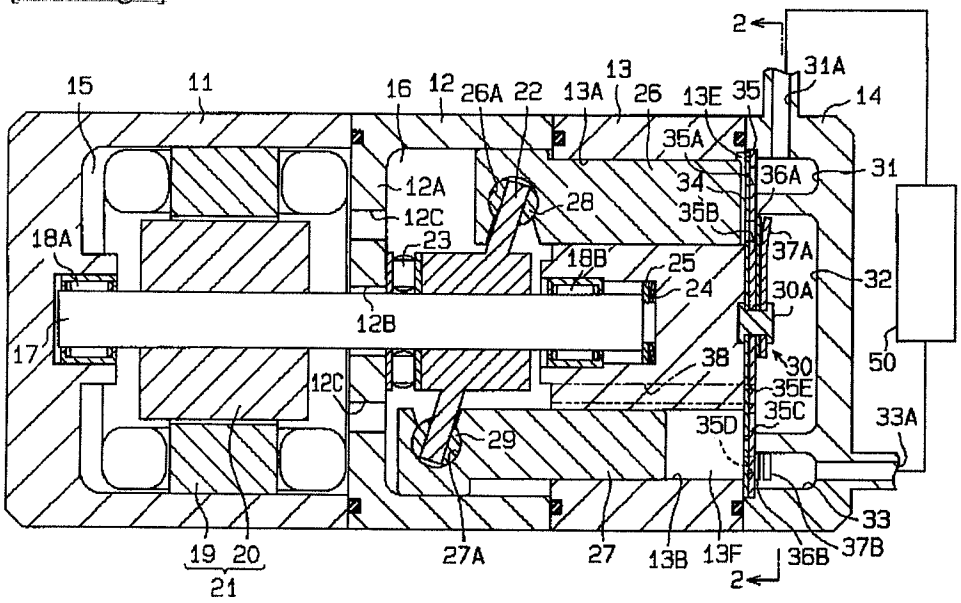
[Translation done.]

* NOTICES *

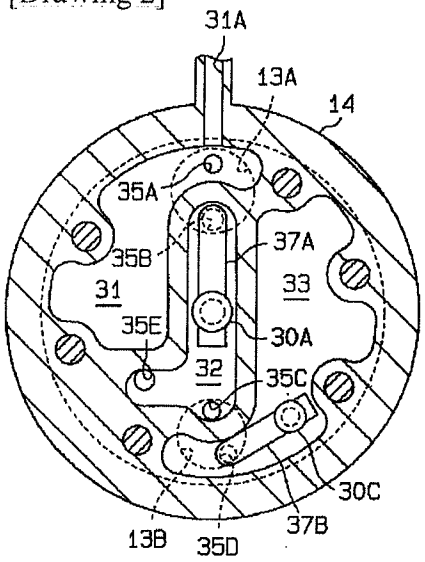
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

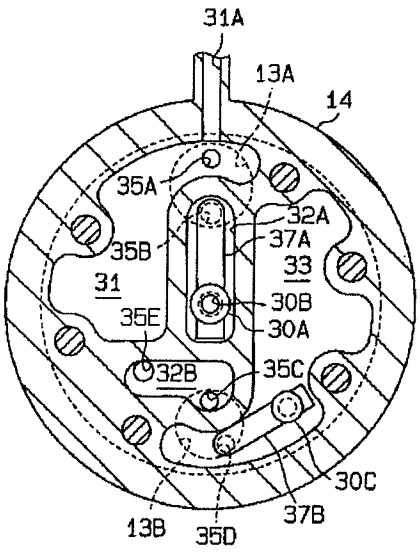
[Drawing 1]



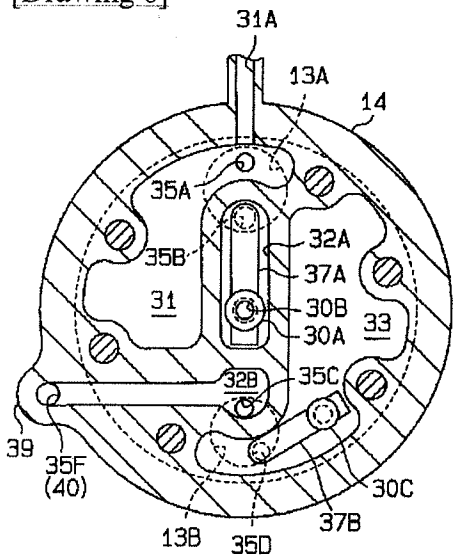
[Drawing 2]



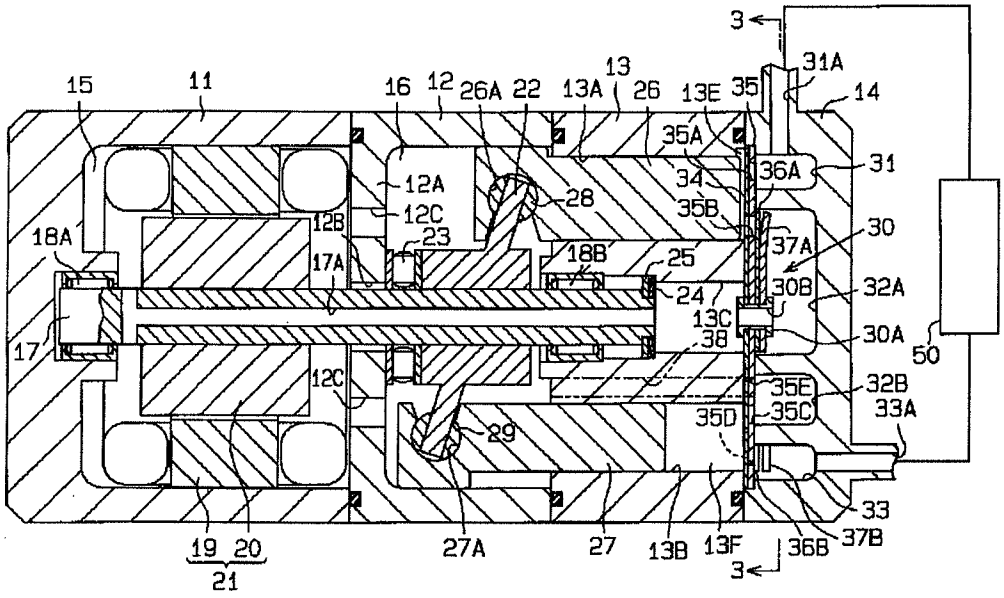
[Drawing 3]



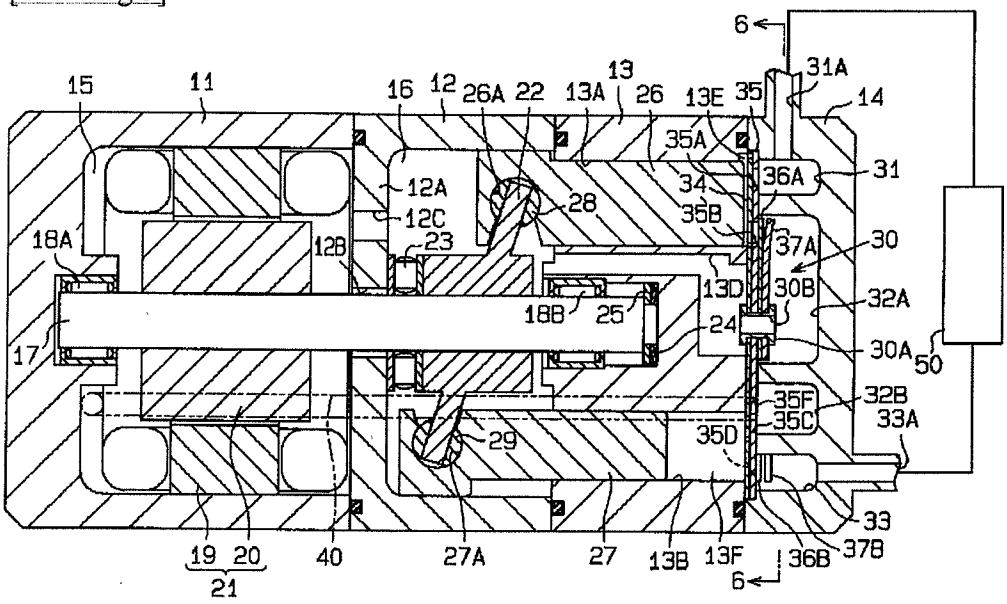
[Drawing 6]



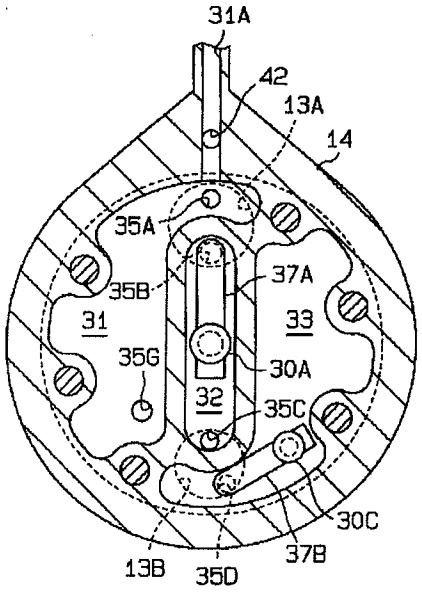
[Drawing 4]



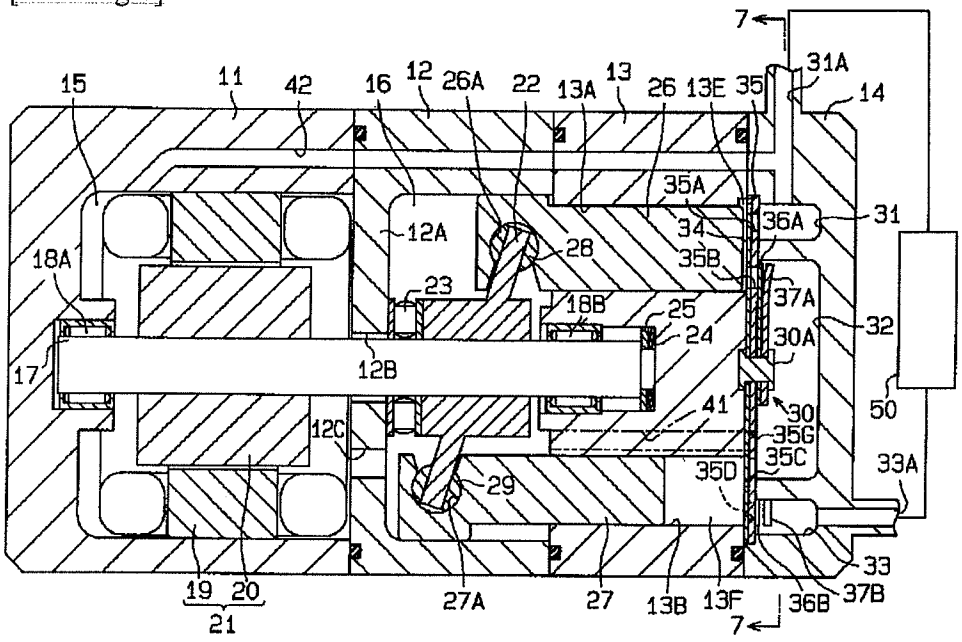
[Drawing 5]



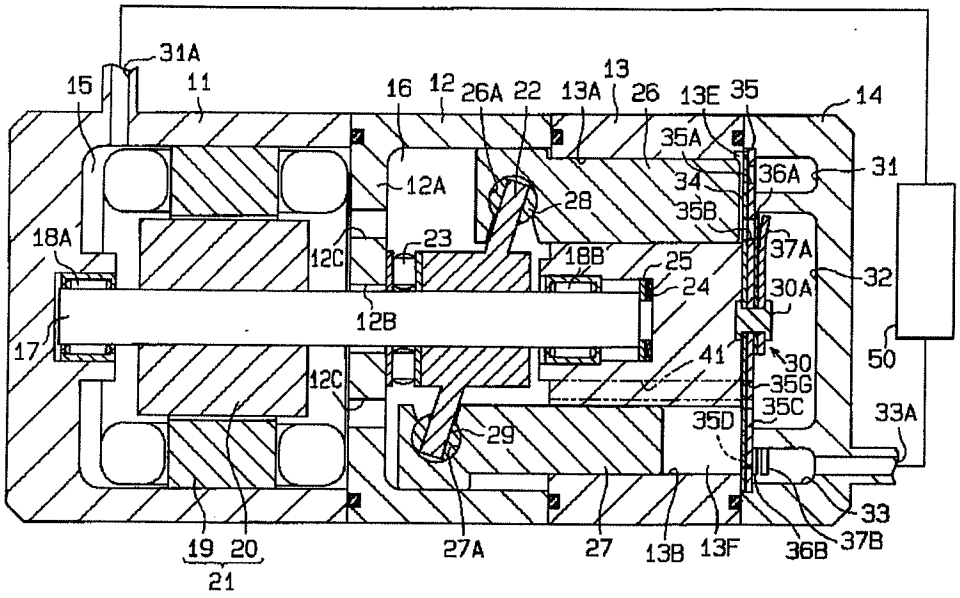
[Drawing 7]



[Drawing 8]



[Drawing 9]



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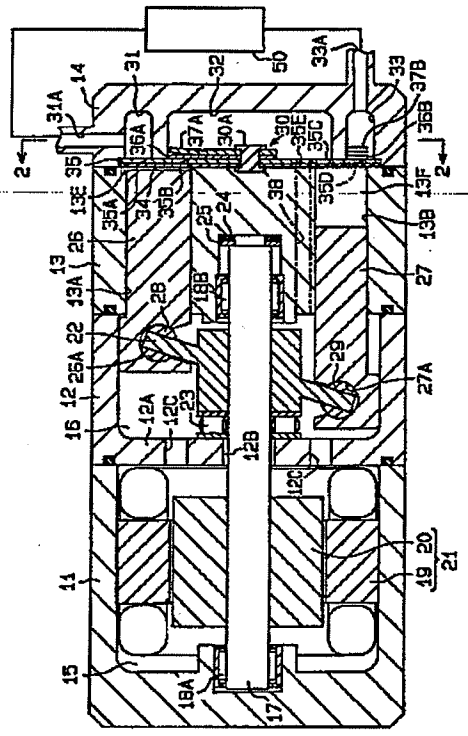
最終頁に続く

(54)【発明の名称】　電動斜板圧縮機

(57)【要約】
【課題】　機体の小型軽量化を可能とし、効率的にモータ室及び斜板室を冷却することができる電動圧縮機を提供する。
【解決手段】　圧縮機は、電動モータ２１及び斜板２２と、それぞれが設けられたモータ室１５及び斜板室１６を備えている。この圧縮機には、ケース内冷媒経路のうち外部冷媒回路に接続される吐出室３３以外の部分と前記モータ室１５とを連通する連通路が設けられる。この連通路は前記斜板室１６が含まれるように構成されるため、吐出冷媒より低温低圧の冷媒ガスがモータ室１５及び斜板室１６に供給される。



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【特許請求の範囲】

【請求項1】　ケース内に形成されたモータ室、斜板室及びシリンダボアと、

前記シリンダボア内に往復動可能に収容されるとともに圧縮作用を行うピストンと、

前記モータ室及び斜板室に挿通された状態で前記ケース内に回転可能に支持され、該モータ室内の電動モータに連結されるとともに、前記モータの駆動によって、前記斜板室内に配設された斜板を介して前記ピストンを往復駆動する駆動軸とを備えた電動斜板圧縮機において、

前記圧縮機のケース内冷媒経路のうち外部冷媒回路に連通される吐出室以外の部分と前記モータ室とを連通する連通路が設けられるとともに、該連通路には前記斜板室が含まれることを特徴とする電動斜板圧縮機。

【請求項2】　前記圧縮機は、外部冷媒回路からの吸入冷媒を吸入して圧縮する第1のシリンダボアと、少なくとも1度圧縮された中間圧の冷媒を吸入して圧縮する他のシリンダボアとを備えた多段式圧縮機であり、

前記連通路は、前記中間圧の冷媒が存在する中間圧室と前記モータ室とを連通することを特徴とする請求項1に記載の電動斜板圧縮機。

【請求項3】　前記モータ室は、前記連通路内の前記斜板室よりも上流側に配置され、冷媒の少なくとも一部は該モータ室を通過した後に該斜板室を通過することを特徴とする請求項1または2に記載の電動斜板圧縮機。

【請求項4】　前記連通路は、前記外部冷媒回路からの吸入冷媒が存在する吸入室及び該吸入冷媒を該吸入室に導入する吸入孔のうち少なくともいずれか一方と、前記モータ室とを連通することを特徴とする請求項1に記載の電動斜板圧縮機。

【請求項5】　前記吸入室または吸入孔から分岐形成された分岐連通路を有し、該分岐連通路は、前記圧縮機のケース内冷媒経路を構成するとともに、前記モータ室及び斜板室の上流側に配置されることを特徴とする請求項4に記載の電動斜板圧縮機。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、例えば車両用空調装置に使用される電動斜板圧縮機に関するものである。

【0002】

【従来の技術】車両用空調装置などの熱交換装置の冷媒循環回路に組み込まれる圧縮機として電動圧縮機が知られている。一般に電動圧縮機は、その外殻となるケース内に電動モータおよびこのモータによって駆動される冷媒圧縮機構を備えている。該冷媒圧縮機構は、圧縮機内のシリンダボアに往復動可能に収容されたピストンと、圧縮機内に区画形成された斜板室に設けられ前記モータの回転運動を該ピストンの往復運動に変換する斜板などから構成される。このモータには高回転を実現する回転能力と高い負荷トルクに耐え得る駆動力が望まれるため、前記圧縮機には高出力なモータが備えられる必要がある。しかし高出力モータでもって高い回転負荷に対抗するという構成においては、モータの高発熱化が促され、該モータの雰囲気温度上昇が更に促進されてしまう。この雰囲気温度上昇は当然ながら該モータ自身を高温にするため、この高温化による該モータ自身の減磁が引き起こす回転効率の低下というリスクがつきまとう。そのため、このモータの高温化を避けるためのモータ冷却が必要となっている。

【0003】また、前記斜板が高速回転されると、前記ピストンとの間に介装されたシューとの摺動摩擦により高熱状態となるため、耐久性や摺動安定性の面から、該斜板の冷却も併せて必要となる。

【0004】前記モータ冷却のための構成として、圧縮機内の冷媒を該モータが備えられたモータ室に導入するというものが知られている（特開平7-133779号公報）。この構成は、前記冷媒圧縮機構から吐出され前記圧縮機の外部下流側の装置（例えば凝縮器）に送られる状態にある吐出冷媒を前記モータ室に導入してモータ冷却を行うというものであった。

【0005】また、特開平9-236092号公報には、前記圧縮機の外部上流側の装置（例えば蒸発器）から該圧縮機に吸入される吸入冷媒を前記モータ室に導入してモータ冷却を行うものが開示されている。

【0006】

【発明が解決しようとする課題】しかしながら、前者の構成ではモータの冷却に使用される吐出冷媒は前記冷媒圧縮機構による圧縮によって高圧且つ高温な状態とされたものであり、このような状態の冷媒を前記モータ冷却に用いた場合、次の二つの課題が誘発される。

【0007】まず第1に、高圧な吐出冷媒を用いることにより、前記ケースの小型軽量化を阻むことになる。つまり、前記モータ室は圧縮機内において比較的容量比率の大きな領域であり、前記ケースをその高圧状態に耐えうるものとするための強度アップ、即ちケースの肉厚増加やケース内部の補強部材の増設・肉厚増大などが必要とされる。

【0008】第2に、冷却のために用いられる冷媒そのものが高温であるため、前記モータ冷却は非効率的なものになる。一方、両者の構成とも前記モータ室への冷媒の導入のみが記載されているに過ぎず、前記斜板の冷却に関しての開示は行われていない。つまり、斜板の過熱に対する対応が考慮されていないのが現状である。

【0009】本発明の目的は、機体の小型軽量化を可能とし、効率的にモータ室及び斜板室を冷却することができる電動斜板圧縮機を提供することにある。

【0010】

【課題を解決するための手段】上記問題点を解決するために、請求項1に記載の発明は、ケース内に形成されたモータ室、斜板室及びシリンダボアと、前記シリンダボ

ア内に往復動可能に収容されるとともに圧縮作用を行うピストンと、前記モータ室及び斜板室に挿通された状態で前記ケース内に回転可能に支持され、該モータ室内の電動モータに連結されるとともに、前記モータの駆動によって、前記斜板室内に配設された斜板を介して前記ピストンを往復駆動する駆動軸とを備えた電動斜板圧縮機において、前記圧縮機のケース内冷媒経路のうち外部冷媒回路に連通される吐出室以外の部分と前記モータ室とを連通する連通路が設けられるとともに、該連通路には前記斜板室が含まれることを要旨とする。

【0011】この発明によれば、電動斜板圧縮機のモータ室及び斜板室は、ケース内冷媒経路内の冷媒が連通路を介して導入されることで、両室内が冷却される。両室内に導入される冷媒は、外部冷媒回路に連通される吐出室内の冷媒、即ち吐出冷媒よりも低温低圧な状態にあるため、吐出冷媒を冷却用に使用する構成に比較して、両室内温度及び圧力はより低下した状態になる。つまり、冷却効率を向上させるとともに、ケースの耐圧強度の低減を可能にする。

【0012】請求項2に記載の発明は、請求項1に記載の発明において、前記圧縮機は、外部冷媒回路からの吸入冷媒を吸入して圧縮する第1のシリンダボアと、少なくとも1度圧縮された中間圧の冷媒を吸入して圧縮する他のシリンダボアとを備えた多段式圧縮機であり、前記連通路は、前記中間圧の冷媒が存在する中間圧室と前記モータ室とを連通することを要旨とする。

【0013】この発明によれば、前記モータ室及び斜板室は、多段式圧縮機の中間圧室に吐出された中間圧冷媒によって冷却される。中間圧冷媒は前記吐出冷媒よりも充分に低温低圧であるため、冷却効率の向上及びケース耐圧強度の低減のためには好適なものである。

【0014】請求項3に記載の発明は、請求項1または2に記載の発明において、前記モータ室は、前記連通路内の前記斜板室よりも上流側に配置され、冷媒の少なくとも一部は該モータ室を通過した後に該斜板室を通過することを要旨とする。

【0015】この発明によれば、前記斜板室が冷却される前に前記モータ室が冷却される。即ち、少なくとも該斜板室内で温度上昇していない低温な冷媒によって該モータ室が冷却されるため、該モータ室の冷却効率は更に向上する。

【0016】請求項4に記載の発明は、請求項1に記載の発明において、前記連通路は、前記外部冷媒回路からの吸入冷媒が存在する吸入室及び該吸入冷媒を該吸入室に導入する吸入孔のうち少なくともいずれか一方と、前記モータ室とを連通することを要旨とする。

【0017】この発明によれば、前記モータ室及び斜板室には、前記外部冷媒回路からの吸入冷媒が導入される。該吸入冷媒は前記中間圧冷媒よりも更に低温低圧である。従って、冷却効率の向上及びケース耐圧強度の低減のためには更に好適なものであるといえる。

【0018】請求項5に記載の発明は、請求項4に記載の発明において、前記吸入室または吸入孔から分岐形成された分岐連通路を有し、該分岐連通路は、前記圧縮機のケース内冷媒経路を構成するとともに、前記モータ室及び斜板室の上流側に配置されることを要旨とする。

【0019】この発明によれば、前記吸入冷媒は、分岐連通路を介して前記モータ室及び斜板室に導入される。その際、該吸入冷媒の一部は両室に導入されるが、一部は両室に導入されることなくシリンダボアに吸入される。従って、両室内で高温化される吸入冷媒は、その一部のみにすぎないため、前記シリンダボア内に吸入される冷媒の温度は比較的上昇しない。つまり、このシリンダボアに吸入される冷媒の温度上昇に伴う比体積の増大が引き起こす圧縮効率の低下が抑えられる。

【0020】

【発明の実施の形態】（第1の実施形態）以下、本発明を冷媒として二酸化炭素を使用する多段式の電動斜板圧縮機に具体化した第1の実施形態を図1および図2に従って説明する。なお、図1の左方を圧縮機の前方とし、右方を後方とする。

【0021】図1に示すように、電動斜板圧縮機は、モータハウジング11、フロントハウジング12、シリンダブロック13及びリアハウジング14を備えている。これら各ハウジング11，12，14及びシリンダブロック13は、図示しない複数本の通しボルトにより相互に接合固定されて、ほぼ円筒形状をした該圧縮機のケースを構成する。モータハウジング11とフロントハウジング12とに囲まれた領域にはモータ室15が、フロントハウジング12とシリンダブロック13とに囲まれた領域には斜板室16がそれぞれ区画形成されている。

【0022】モータハウジング11とシリンダブロック13との間には、モータ室15および斜板室16に挿通された駆動軸17が前後一対のラジアルベアリング18A、18Bを介して回転可能に支持されている。駆動軸17はフロントハウジング12に形成された壁部12Aの中心孔12Bを遊嵌している。

【0023】モータ室15にはステータ19と、駆動軸17上に一体回転可能に固定されたロータ20とよりなる電動モータ21が収容されている。斜板室16において、駆動軸17上には円盤形状の斜板22が一体回転可能に固定され、斜板22と壁部12Aとの間にはスラストベアリング23が配設されている。一体化された駆動軸17および斜板22は、シリンダブロック13の中央に形成された収容凹部内に配設されたバネ24によって前方付勢された座金25と、スラストベアリング23とによってスラスト方向（駆動軸軸線方向）に位置決めされている。

【0024】シリンダブロック13には、第1のシリンダボア13Aと、該シリンダボア13Aよりも小径に形

成された他のシリンダボアとしての第2のシリンダボア１３Ｂとが、互いに駆動軸１７を挟んで対向する位置に形成されている。各シリンダボア１３Ａ，１３Ｂには、片頭型の第1および第2のピストン２６，２７がそれぞれ前後方向に往復摺動可能に収容されており、各ボア１３Ａ，１３Ｂ内には各ピストン２６，２７の往復摺動に応じて体積変化する圧縮室１３Ｅ，１３Ｆがそれぞれ区画されている。各ピストン２６，２７の前方部には、凹部２６Ａ，２７Ａがそれぞれ設けられており、この凹部２６Ａ，２７Ａには、一対のシュー２８，２９が収容されている。両シュー２８，２９に斜板２２の周縁部が摺動可能に挟持されることによって、各ピストン２６，２７は斜板２２に作動連結されている。このため、前記電動モータ２１による駆動軸１７の回転に伴い、斜板２２がこの駆動軸１７と同期回転することで、斜板２２の回転運動がその傾斜角度に対応するストロークでの各ピストン２６，２７の往復直線運動に変換される。

【００２５】シリンダブロック１３とリアハウジング１４との間には、弁形成体３０が両者に挟まれるようにして設けられている。図1及び図2に示すように、弁形成体３０とリアハウジング１４との間には、リアハウジング１４の周壁に設けられた吸入孔３１Ａを介して外部冷媒回路５０からの吸入冷媒が導入される吸入室３１が形成されている。更に、各シリンダボア１３Ａ，１３Ｂ同士を接続する中間圧室３２と、リアハウジング１４の後壁に設けられた吐出孔３３Ａを介して外部冷媒回路５０に連通された吐出室３３とが区画形成されている。

【００２６】弁形成体３０は、吸入弁形成部材３４、ポート形成部材３５、第1及び第2吐出弁３６Ａ，３６Ｂ、第1及び第2リテーナ３７Ａ，３７Ｂ並びにピン３０Ａ，３０Ｃからなる。

【００２７】ポート形成部材３５には、ポート３５Ａ，３５Ｂ，３５Ｃ，３５Ｄ，３５Ｅが形成されている。ポート３５Ａは吸入室３１と第1のシリンダボア１３Ａとを連通させ、ポート３５Ｂは第1のシリンダボア１３Ａと中間圧室３２とを連通させる。また、ポート３５Ｃは第2のシリンダボア１３Ｂと中間圧室３２とを連通させ、ポート３５Ｄは第2のシリンダボア１３Ｂと吐出室３３とを連通させる。更に、ポート３５Ｅは、後述する連通孔３８を介して中間圧室３２と斜板室１６とを連通させる。

【００２８】また、吸入弁形成部材３４には、ポート３５Ａ，３５Ｃに整合する位置に吸入弁が形成されている。更に、中間圧室３２内では、吐出弁３６Ａ及びリテーナ３７Ａが、ピン３０Ａによって吸入弁形成部材３４及びポート形成部材３５に固定されている。また、図2に示すように吐出室３３内では、吐出弁３６Ｂ及びリテーナ３７Ｂが、ピン３０Ｃによって両形成部材３４，３５に固定されている。

【００２９】なお、吸入孔３１Ａ、吸入室３１、ポート３５Ａ、第1のシリンダボア１３Ａ、ポート３５Ｂ、中間圧室３２、ポート３５Ｃ、第2のシリンダボア１３Ｂ、ポート３５Ｄ、吐出室３３及び吐出孔３３Ａによってケース内冷媒経路が構成される。

【００３０】シリンダブロック１３には、中間圧室３２と斜板室１６とを連通させる連通孔３８が形成されている。また、フロントハウジング１２の壁部１２Ａには、斜板室１６とモータ室１５とを連通させる連通孔１２Ｃが形成されている。連通孔３８、斜板室１６、フロントハウジング１２の中心孔１２Ｂ及び連通孔１２Ｃによって中間圧室３２とモータ室１５とを連通する連通路が構成される。

【００３１】次に、上記のように構成された圧縮機の作用について説明する。電動モータ２１により駆動軸１７が回転されると、斜板２２が一体に回転する。斜板２２の回転に伴って各ピストン２６，２７がそれぞれシュー２８，２９を介して往復駆動される。この駆動の継続によって各圧縮室１３Ｅ、１３Ｆでは、冷媒の吸入、圧縮及び吐出が順次繰り返される。

【００３２】吸入孔３１Ａから吸入室３１に至った冷媒は、ポート３５Ａを介して圧縮室１３Ｅに吸入されると、第1のピストン２６の後方移動による圧縮作用を受けた後、ポート３５Ｂを介して中間圧室３２に吐出される。

【００３３】更に、この中間圧室３２内の冷媒の一部は、ポート３５Ｃを介して圧縮室１３Ｆに吸入され、第2のピストン２７の移動による圧縮作用の後、ポート３５Ｄを介して吐出室３３に吐出される。吐出室３３に吐出された冷媒は、吐出孔３３Ａから外部冷媒回路５０に送り出される。

【００３４】一方、前述の中間圧室３２内の冷媒のうち圧縮室１３Ｆに吸入されなかったものの少なくとも一部は、ポート３５Ｅ及び連通孔３８を通過して斜板室１６に供給される。更に、スラストベアリング２３、フロントハウジング１２の中心孔１２Ｂ及び連通孔１２Ｃを介して斜板室１６からモータ室１５へと供給される。このモータ室１５または斜板室１６への冷媒の供給は、電動モータ２１の回転に伴うロータ２０及び斜板２２の回転による撹拌によって効果的に行われる。そして、モータ室１５に供給された冷媒により電動モータ２１が冷却され、斜板室１６に供給された冷媒により斜板２２及びシュー２８，２９等が冷却される。

【００３５】また、中間圧室３２内の冷媒は圧縮室１３Ｅ内での圧縮作用を受けただけであり、前記二つの圧縮室１３Ｅ，１３Ｆ双方内で圧縮された吐出室３３内の冷媒に比して充分に低温であり低圧なものであることは言うまでもない。

【００３６】本実施形態によれば以下のような効果を得ることができる。

（１）　モータ室１５及び斜板室１６の冷却のために、

吐出室３３よりも充分低圧な中間圧室３２内の冷媒を導入している。そのため、モータ室１５及び斜板室１６内を、吐出室３３内の冷媒圧力ほどの過大な圧力にさらすことがなく、モータ室１５及び斜板室１６と対応する部分の該ケースの耐圧強度を低く設定することが可能になる。従って、ケースの小型化及び耐久性向上を図ることができる。また、中間圧室３２内の冷媒は吐出室３３内のものよりも充分低温であるため、効率よくモータ室１５を冷却することができる。その結果、高速運転を行ったり、モータ２１に高負荷がかかったりした場合にも、該モータ２１の減磁が防止される。

【００３７】（２）　中間圧室３２内の冷媒をモータ室１５のみならず斜板室１６にも導入している。即ち、圧縮機ケース内の広範囲に亘って、該ケース内の冷却を行っている。従って、高速運転時やモータ２１に高負荷がかかったときなどにおけるシュー２８，２９の過熱を防止することができる。

【００３８】（３）　また、中間圧室３２内の冷媒の斜板室１６への導入は、ベアリング１８Ｂ，２３、斜板２２、シュー２８，２９、ピストン２６，２７及び潤滑油（二酸化炭素中にミスト状態で含まれる）の効率的な冷却を可能とする。即ち、高温な状態にある各部材（ベアリング１８Ｂ，２３、斜板２２、シュー２８，２９及びピストン２６，２７）の摺動による潤滑油の劣化及び潤滑油そのものの高温化による劣化を抑えることができる。

【００３９】更に、中間圧室３２内の冷媒の斜板室１６への導入によって斜板室１６内の圧力は中間圧室３２内の圧力と同じ中間圧力となる。つまり、第１のピストン２６の前側に作用する圧力と、圧縮室１３Ｅの吐出時に該ピストン２６の後側に作用する圧力とがほぼ等しい状態となる。また、第２のピストン２７の前側に作用する圧力と、圧縮室１３Ｆの吐出時に該ピストン２７の後側に作用する圧力との圧力差も従来に比べて小さくなる。即ち、各ピストン２６，２７にかかる負荷荷重が最も大きくなる吐出工程にあるときの各ピストン２６，２７の前側と後側との圧力差が少なくなるため、斜板２２、シュー２８，２９及びピストン２６，２７に作用する力は小さくなる。従って、各部材（斜板２２、シュー２８，２９及びピストン２６，２７）間の高負荷な摺動による潤滑油の劣化を抑えることができる。

【００４０】（４）　中間圧室３２内の冷媒は圧縮室１３Ｅで既に圧縮作用を受けた冷媒であり、吸入室３１内の冷媒よりも高温である。そのため、中間圧室３２から導入した冷媒を用いてモータ室１５を冷却する上記実施形態の構成では、吸入室３１から導入した冷媒を用いた構成に比して冷媒温度上昇の度合いが少ない。即ち、冷媒の比体積増加による圧縮効率低下の影響を受けにくい。

【００４１】（第２の実施形態：図３及び図４参照）この第２の実施形態の電動斜板圧縮機は、前記第１の実施形態においてケース内冷媒経路及び連通路の構成を変更したものであり、その他の点では第１の実施形態の電動斜板圧縮機と同一の構成になっている。従って、第１の実施形態と共通する構成部分については図面上に同一符号を付して重複した説明を省略する。

【００４２】弁形成体３０とリアハウジング１４との間には、吸入室３１及び吐出室３３の他に二つの中間圧室３２Ａ，３２Ｂが区画形成されている。第１の中間圧室３２Ａは、ポート３５Ｂと後述する孔３０Ｂとに連通され、第２の中間圧室３２Ｂは、ポート３５Ｃ，３５Ｅに連通されている。

【００４３】ピン３０Ａには、ピン３０Ａを軸方向に貫通する孔３０Ｂが形成されている。シリンダブロック１３には、駆動軸１７の後端部が収容される収容凹部と孔３０Ｂとを連通するシリンダブロック中心孔１３Ｃが形成されている。駆動軸１７には、モータ室１５内の前方域とシリンダブロック中心孔１３Ｃとを連通する駆動軸連通孔１７Ａが形成されている。また、シリンダブロック１３には、斜板室１６とポート３５Ｅとを常時連通させる連通孔３８が形成されている。従って、各孔３０Ｂ，１３Ｃ，１７Ａ，１２Ｂ，１２Ｃ，３８、ポート３５Ｅ及び斜板室１６によって、モータ室１５を介して両中間圧室３２Ａ，３２Ｂ間を常時連通する連通路が構成される。

【００４４】なお、この連通路及びモータ室１５に加え、吸入孔３１Ａ、吸入室３１、ポート３５Ａ、第１のシリンダボア１３Ａ、ポート３５Ｂ、第１及び第２の中間圧室３２Ａ，３２Ｂ、ポート３５Ｃ、第２のシリンダボア１３Ｂ、ポート３５Ｄ、吐出室３３及び吐出孔３３Ａによってケース内冷媒経路が構成される。

【００４５】吸入室３１から第１のシリンダボア１３Ａに吸入され圧縮された冷媒は、ポート３５Ｂを介して第１の中間圧室３２Ａに吐出される。そして、この第１の中間圧室３２Ａ内の冷媒は、孔３０Ｂ、シリンダブロック中心孔１３Ｃ及び駆動軸連通孔１７Ａを介してモータ室１５内の前方域に導入される。更に、このモータ室１５内に導入された冷媒は、ステータ１９とロータ２０との隙間を通過した後、連通孔１２Ｃ、中心孔１２Ｂ及びスラストベアリング２３を介して斜板室１６に導入される。その後、斜板室１６内の冷媒は、連通孔３８を介して第２の中間圧室３２Ｂに導入される。

【００４６】第２の中間圧室３２Ｂ内の冷媒は、ポート３５Ｃを介して第２のシリンダボア１３Ｂに吸入された後、第２のピストン２７により更に圧縮され、ポート３５Ｄ、吐出室３３及び吐出孔３３Ａを介して外部冷媒回路に吐出される。

【００４７】この実施形態によれば、前記実施形態の（１）～（４）の効果の他に以下のような効果を得ることができる。

（5）　モータ室１５及び斜板室１６を、他のバイパス経路を有さない唯一のケース内冷媒経路に含め、冷媒が両室１５，１６内を強制的に通過するようにした。従って、前記実施形態に比較して、両室１５，１６内の冷却効果が向上する。

【００４８】（６）　第１の中間圧室３２Ａ内の冷媒を、先ずモータ室１５に導入してから斜板室１６に導入している。即ち、第１の中間圧室３２Ａ内の冷媒を、斜板室１６を介さずに、同中間圧室３２Ａからモータ室１５に直接的に導入している。従って、斜板室１６を通過する前の低温状態の冷媒によって、モータ室１５をより効率的に冷却することができる。

【００４９】（７）　モータ室１５の前方域に導入された冷媒がステータ１９とロータ２０との隙間を介してモータ室１５の後方域へと通過するように構成されている。即ち、冷媒は、電動モータ２１の表面の広範囲を冷却する。これにより、電動モータ２１を効率よく冷却することができる。

【００５０】（第３の実施形態：図５及び図６参照）この実施形態の電動斜板圧縮機は、前記第２の実施形態においてケース内冷媒経路及び連通路の構成を変更したものであり、その他の点では第２の実施形態の電動斜板圧縮機と同一の構成になっている。従って、第２の実施形態と共通する構成部分については図面上に同一符号を付して重複した説明を省略する。

【００５１】図６に示すように、第２の中間圧室３２Ｂはリアハウジング１４の外周部近傍まで延出形成されている。圧縮機ケース（図６ではリアハウジング１４）の外周面上には駆動軸１７と平行に膨出形成された冷媒冷却手段としての凸部３９内に連通孔４０が形成されている。モータ室１５と中間圧室３２Ｂとは、連通孔４０及びポート３５Ｆを介して連通されている。

【００５２】連通孔４０は、モータハウジング１１、フロントハウジング１２及びシリンダブロック１３に亘って貫通形成されており、ポート３５Ｆとモータ室１５内の前方域とを常時連通している。

【００５３】シリンダブロック１３には、斜板室１６と孔３０Ｂとを連通するシリンダブロック連通孔１３Ｄが貫通形成されている。従って、各孔３０Ｂ，１３Ｄ，１２Ｂ，１２Ｃ，４０、ポート３５Ｆ及び斜板室１６によって、モータ室１５を介して両中間圧室３２Ａ，３２Ｂ間を常時連通する連通路が構成される。

【００５４】なお、この連通路及びモータ室１５に加え、吸入孔３１Ａ、吸入室３１、ポート３５Ａ、第１のシリンダボア１３Ａ、ポート３５Ｂ、第１及び第２の中間圧室３２Ａ，３２Ｂ、ポート３５Ｃ、第２のシリンダボア１３Ｂ、ポート３５Ｄ、吐出室３３及び吐出孔３３Ａによってケース内冷媒経路が構成される。

【００５５】この実施形態では、第１の中間圧室３２Ａ内の中間圧冷媒は、孔３０Ｂ及びシリンダブロック連通孔１３Ｄを介して斜板室１６に導入される。斜板室１６内の冷媒は、フロントハウジング１２の連通孔１２Ｃ、中心孔１２Ｂ及びスラストベアリング２３を介してモータ室１５内の後方域に導入される。このモータ室１５に導入された冷媒は、ステータ１９とロータ２０との隙間を通過した後、モータ室１５内の前方域に形成された連通孔４０の開口部内に導入され、連通孔４０及びポート３５Ｆを介して第２の中間圧室３２Ｂに導入される。第２の中間圧室３２Ｂ内の冷媒は、ポート３５Ｃを介して圧縮室１３Ｆに吸入された後、第２のピストン２７により更に圧縮され、ポート３５Ｄ、吐出室３３及び吐出孔３３Ａを介して外部冷媒回路に吐出される。

【００５６】この実施形態によれば、前記（１）～（５）の効果の他に以下のような効果を得ることができる。

（８）　第１の中間圧室３２Ａ内の冷媒を、先ず斜板室１６に導入してからモータ室１５に導入している。即ち、第１の中間圧室３２Ａ内の冷媒を、モータ室１５を介さずに、同中間圧室３２Ａから斜板室１６に直接的に導入している。従って、モータ室１５を通過する前の低温状態の冷媒によって、斜板室１６をより効率的に冷却することができる。

【００５７】（９）　第１の中間圧室３２Ａから斜板室１６及びモータ室１５を経た冷媒が、連通孔４０を通過して第２の中間圧室３２Ｂに至るようにした。この連通孔４０は圧縮機ケースの外周部から更に突出した凸部内に形成されているため連通孔４０内の熱を圧縮機外部に逃がしやすい。そのため、この連通孔４０を通過する冷媒は冷却されてから第２の中間圧室３２Ｂに至ることになる。つまり、低温化されて比体積が減少した冷媒が第２のシリンダボア１３Ｂに吸入されるため、圧縮効率の向上を図ることができる。

【００５８】（第４の実施形態：図７及び図８参照）この実施形態の電動斜板圧縮機は、前記第１の実施形態においてケース内冷媒経路及び連通路の構成を変更したものであり、その他の点では第１の実施形態の電動斜板圧縮機と同一の構成になっている。従って、第１の実施形態と共通する構成部分については図面上に同一符号を付して重複した説明を省略する。

【００５９】ポート形成部材３５に形成されている各ポート３５Ａ，３５Ｂ，３５Ｃ，３５Ｄ，３５Ｇのうち、ポート３５Ｇは、シリンダブロック１３に貫通形成された連通孔４１とともに吸入室３１と斜板室１６とを連通させる常時連通ポートである。

【００６０】また、モータ室１５の前方域は、吸入孔３１Ａから分岐形成された分岐連通路４２によって該吸入孔３１Ａと常時連通している。分岐連通路４２は、モータハウジング１１、フロントハウジング１２、シリンダブロック１３及びリアハウジング１４に亘って、モータ室１５と吸入孔３１Ａとの間に貫通形成されている。

【0061】なお、分岐連通路42、孔12B，12C、斜板室16、連通孔41及びポート35Gによって、モータ室15を介して吸入孔31Aと吸入室31とを常時連通する連通路が構成される。また、この連通路及びモータ室15によってケース内冷媒経路の一部が構成される。

【0062】外部冷媒回路50から吸入孔31Aに吸入された冷媒の一部はそのまま吸入孔31Aを通過して吸入室31に至り、その他の冷媒は分岐連通路42に導入されてモータ室15の前方域に至る。このモータ室15に導入された冷媒は、ステータ19とロータ20との隙間を通過した後、連通孔12C、中心孔12B及びスラストベアリング23を介して斜板室16に導入される。その後、斜板室16内の冷媒は、連通孔41を介して吸入室31に導入される。

【0063】この実施形態によれば以下のような効果を得ることができる。

（10）　圧縮される前の吸入冷媒をモータ室15及び斜板室16に導入している。即ち、圧縮作用によって温度上昇する以前の低温状態の冷媒を用いている。従って、モータ室15及び斜板室16をより冷却することができる。

【0064】（11）　吸入孔31Aから分岐形成された分岐連通路42を設け、外部冷媒回路50からの吸入冷媒の一部をモータ室15及び斜板室16を経由させて吸入室31へ、そして残りを直接吸入室31へ導入するようにした。即ち、両室15，16内で昇温される冷媒を、外部冷媒回路50からの吸入冷媒の一部分のみとし、残りの吸入冷媒は昇温されないようにした。従って、圧縮室13Eに吸入される冷媒の温度上昇が抑えられるため、冷媒の比体積の増加による圧縮効率の低下を抑えることができる。

【0065】（12）　モータ室15及び斜板室16内に、吐出室33更には中間圧室32に吐出された冷媒よりも充分低圧な吸入圧冷媒を導入している。そのため、圧縮機ケースの小型化及び耐久性向上を図ることができる。

【0066】（13）　分岐連通路42からの冷媒を、先ずモータ室15に導入してから斜板室16に導入している。従って、比較的高温な斜板室16を通過していない低温状態の冷媒によって、モータ室15をより効率的に冷却することができる。

【0067】（第5の実施形態：図9参照）この実施形態の電動斜板圧縮機は、前記第4の実施形態に比して、分岐連通路42を設けず、モータハウジング11に設けられた吸入孔31Aが外部冷媒回路とモータ室15の前方域との間を連通するように形成された点が異なっている。従って、第4の実施形態と共通する構成部分については図面上に同一符号を付して重複した説明を省略する。

【0068】この実施形態では、中心孔12B、連通孔12C、斜板室16、連通孔41及びポート35Gによって、吸入孔31Aと吸入室31とを連通する連通路が構成されている。また、この連通路及びモータ室15に加え、吸入孔31A、吸入室31、ポート35A、第1のシリンダボア13A、ポート35B、中間圧室32、ポート35C、第2のシリンダボア13B、ポート35D、吐出室33及び吐出孔33Aによってケース内冷媒経路が構成される。

【0069】外部冷媒回路50から吸入孔31Aに吸入された冷媒は、モータ室15の前方域に導入される。このモータ室15に導入された冷媒は、ステータ19とロータ20との隙間を通過した後、連通孔12C、中心孔12B及びスラストベアリング23を介して斜板室16に導入される。その後、斜板室16内の冷媒は、連通孔41を介して吸入室31に導入される。

【0070】この実施形態によれば以下のような効果を得ることができる。

（14）　吸入孔31Aをモータハウジング11に設け、外部冷媒回路50からの冷媒を先ずモータ室15に導入してから斜板室16に導入している。即ち、冷媒を、斜板室16を介さずに、外部冷媒回路50から非常に短い経路でもってモータ室15に直接的に導入している。従って、モータ室15に至るまでに全くと言ってもよいほど昇温される機会のない低温な冷媒によって、モータ室15をより効率的に冷却することができる。

【0071】実施の形態は前記に限定されるものではなく、例えば、以下の様態でも実施できる。

○　多段式圧縮機に限らず、冷媒が圧縮機に吸入された後、一度だけ圧縮作用を受けて圧縮機外に吐出される単段式圧縮機に適用してもよい。この場合の単段式圧縮機としては、ブローバイガスによって高圧化された斜板室内の冷媒を、圧力調節弁によって斜板室外に排出して該斜板室内の圧力を調節するタイプのものが挙げられる（特開平11-257219公報）。更に、前記公報（特開平11-257219公報）に記載の固定容量式に限らず、可変容量式のものでも良い。この可変容量式単段圧縮機としては、例えば、斜板の傾角を変更可能に構成するとともに、吸入室と斜板室（クランク室）とを連通する通路に制御弁を設け、制御弁の開閉による斜板室内圧力の制御によって吐出容量の制御を行うものが挙げられる。これら両タイプの圧縮機において、斜板室とモータ室とを通路で連通させて、吐出圧よりも低く吸入圧よりも高い中間圧状態の斜板室内の冷媒を利用すれば、効率的に圧縮機ケース内の冷却を行うことができるとともに、該圧縮機の小型軽量化を図ることができる。

【0072】○　前記第4及び5の実施形態の構成も、単段式圧縮機に適用してもよい。

○　冷媒として、二酸化炭素以外の、例えば、アンモニア等を用いてもよい。

○ 前記各実施形態では、シリンダボア等は2段式のものを1組のみ設けたが、例えば、2組以上設けてもよい。また、3段式以上の多段式としてもよい。

【0073】次に、前記実施形態から把握できる請求項に記載した発明以外の技術的思想について、その効果と共に以下に記載する。

○ 請求項1に記載の発明において、前記圧縮機は、冷媒が該圧縮機吸入後に一度だけ圧縮作用を受けて該圧縮機外に吐出される単段式圧縮機であって、前記斜板室内の高圧冷媒を該斜板室外へ排出する圧力調節手段を有する。この場合、吐出圧よりも低く吸入圧よりも高い中間圧状態の冷媒により、効率的に圧縮機ケース内の冷却を行うことができるとともに、該圧縮機の小型軽量化を図ることができる。

【0074】○ 請求項2に記載の発明において、前記連通路は、前記モータ室及び前記斜板室を連通する連通孔（例えば、図1の中心孔12B及び連通孔12C）と、前記斜板室と前記中間圧室とを連通する連通孔（例えば、図1の連通孔38）とを備える。この場合、吐出冷媒よりも低温低圧な冷媒によって、圧縮機ケースの小型化及び耐久性向上を図ることができるとともに、モータ室及び斜板室の効率のよい冷却が可能である。

【0075】○ 請求項2に記載の発明において、前記連通路は、前記中間圧の冷媒を前記斜板室を経て前記モータ室に導き、前記モータ室を経て他のシリンダボアと連通する中間圧室に導く。この場合、モータ室を通過する前の低温状態の冷媒によって、斜板室をより効率的に冷却することができる。

【0076】○ 請求項2に記載の発明において、前記モータ室及び斜板室を通過した冷媒を冷却する冷媒冷却手段を備える。この場合、冷媒冷却手段により低温化されて比体積が減少した冷媒により、圧縮効率の向上を図ることができる。

【0077】○ 請求項1に記載の発明において、前記連通路は吸入室とモータ室とを連通し、該モータ室には外部冷媒回路からの冷媒が吸入される吸入孔が設けられている。この場合、外部冷媒回路から非常に短い経路でもって、モータ室に至るまでに昇温される機会の少ない低温状態の冷媒によって、モータ室をより効率的に冷却することができる。

【0078】

【発明の効果】以上詳述したように、請求項1～請求項5に記載の本発明によれば、圧縮機の小型軽量化を可能とし、効率的に該圧縮機内を冷却することができる。

【図面の簡単な説明】

【図1】第1の実施形態の電動斜板圧縮機の概要を示す断面図。

【図2】図1の2－2線断面図。

【図3】図4の3－3線断面図。

【図4】第2の実施形態の電動斜板圧縮機の概要を示す断面図。

【図5】第3の実施形態の電動斜板圧縮機の概要を示す断面図。

【図6】図5の6－6線断面図。

【図7】図8の7－7線断面図。

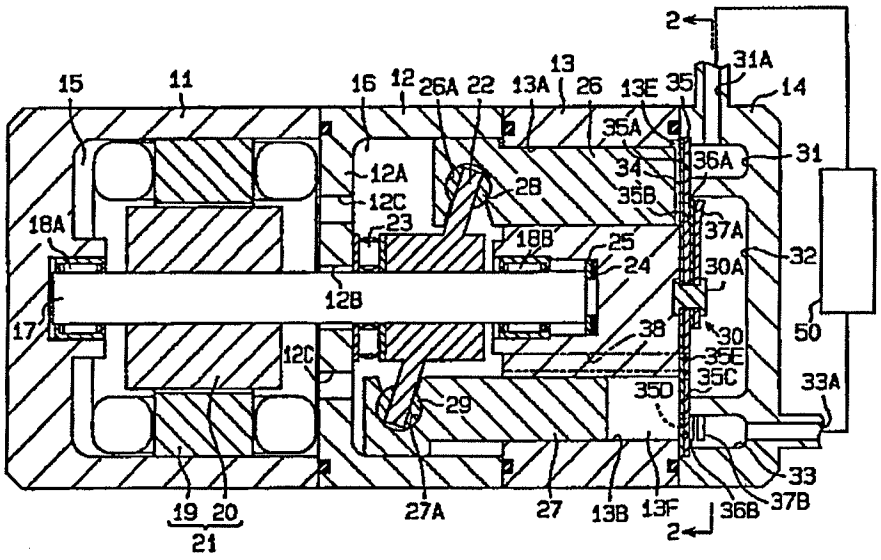
【図8】第4の実施形態の電動斜板圧縮機の概要を示す断面図。

【図9】第5の実施形態の電動斜板圧縮機の概要を示す断面図。

【符号の説明】

11…モータハウジング、12…フロントハウジング、13…シリンダブロック、13A…第1のシリンダボア、13B…第2のシリンダボア、13C…シリンダブロック中心孔、13D…シリンダブロック連通孔（13C，13Dは連通路を構成する）、14…リアハウジング（11，12，13，14は圧縮機ケースを構成する）、15…モータ室、16…斜板室、17…駆動軸、17A…連通路を構成する駆動軸連通孔、21…電動モータ、22…斜板、26…第1のピストン、27…第2のピストン、31…吸入室、32…中間圧室、32A…第1の中間圧室、32B…第2の中間圧室、33…吐出室、38，40，41…連通路を構成する連通孔、42…分岐連通路。

【図1】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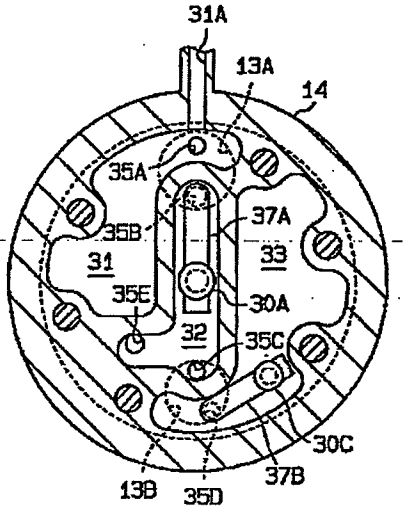
31A
14
15
11
16
12
26A
22
13A
13
26
13E
35
35A
34
36A
31
35B
12A
12C
28
23
18A
18B
25
24
37A
30A
32
12B
17
38
30
35E
35C
50
12C
35D
33A
29
33
19
20
21
27A
27
13B
13F
2
36B
37B

【図2】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13A
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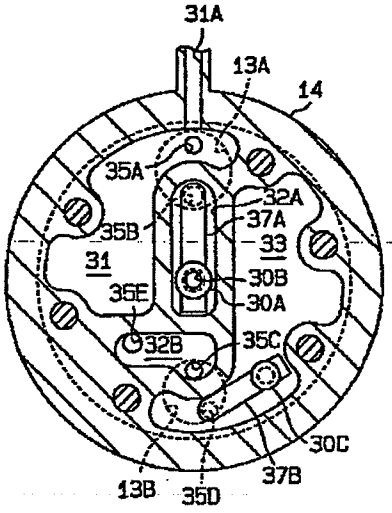
35A
35B
37A
33
31
35E
30A
32
35C
30C
13B
35D
37B

【図3】


31A
13A
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35A
32A
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37A
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35E
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32B
35C
30C
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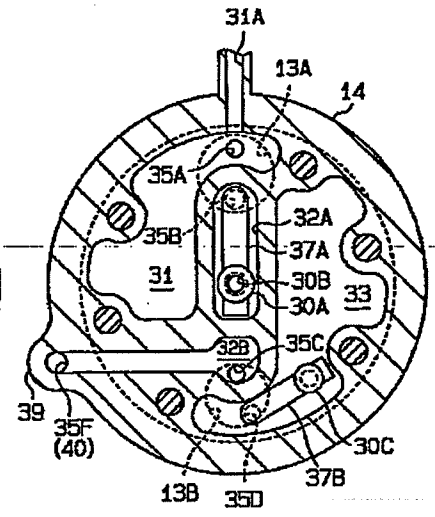
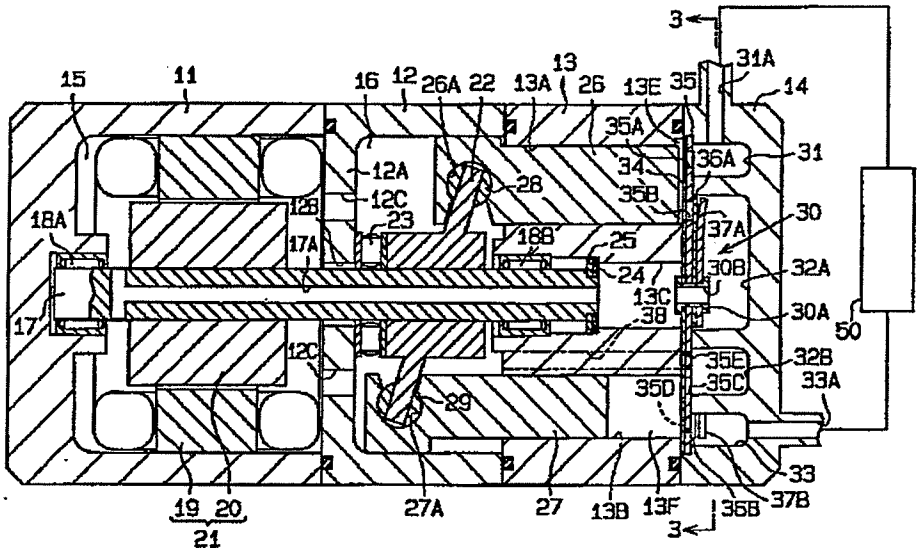
35D
37B

【図6】


31A
13A
14
35A
32A
35B
37A
31
30B
33
30A
32B
35C
39
35F
(40)
30C
13B
35D
37B

【図4】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31A
14
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11
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26A
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13
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13E
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35A
34
36A
31
12A
12C
28
35B
18A
12B
23
37A
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17A
18B
25
30B
32A
24
13C
17
38
30A
50
12C
35E
32B
35C
35D
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33
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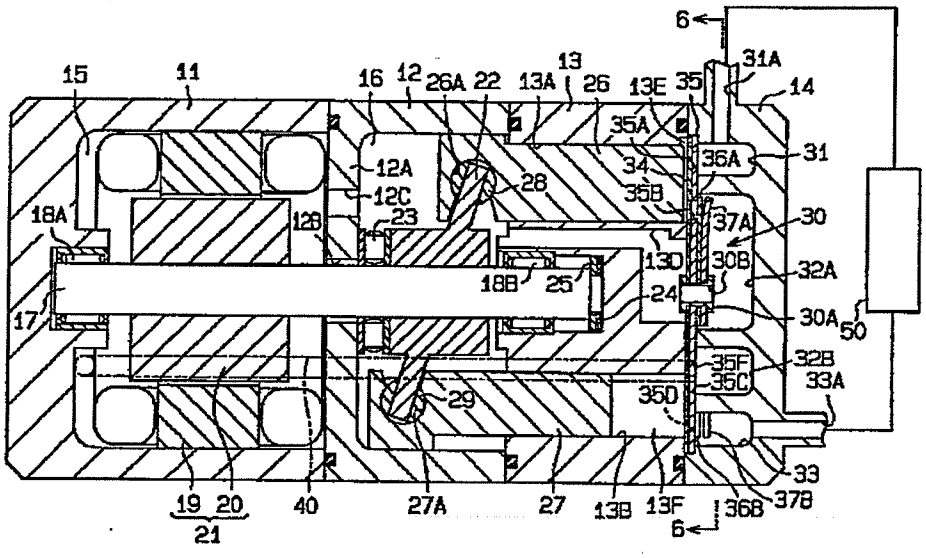
21
27A
27
13B
13F
36B
37B
3

【図5】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12A
12C
28
35B
18A
12B
23
37A
30
13D
30B
32A
18B
25
24
17
30A
50
35F
32B
35C
33A
35D
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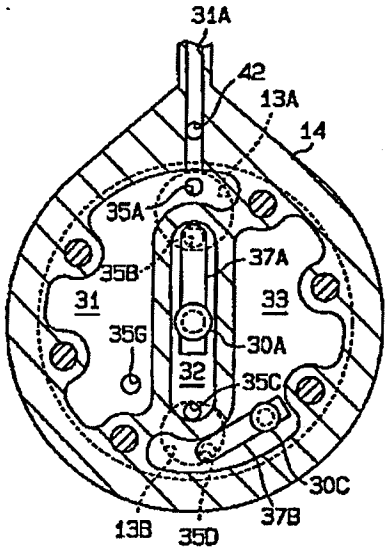
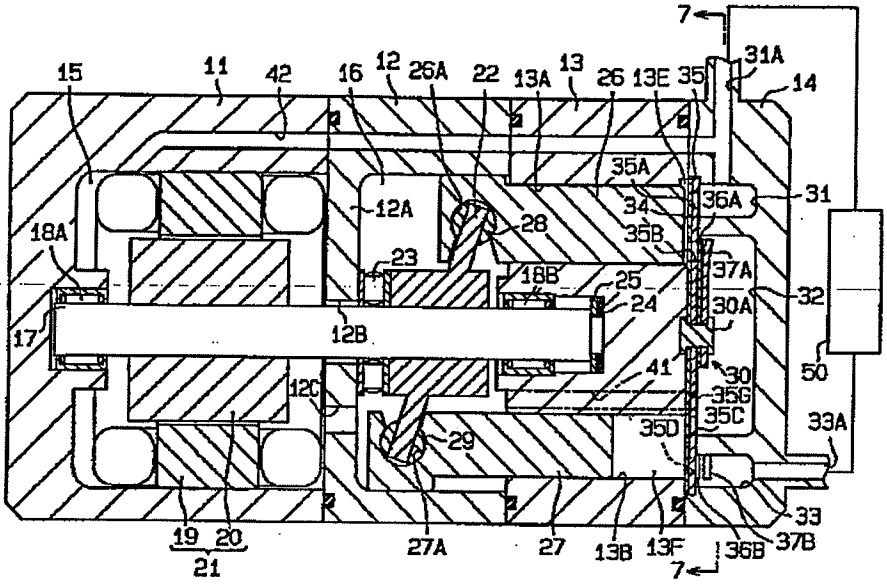
19
20
21
40
27A
27
13B
13F
36B
37B
6

【図7】


31A
42
13A
14
35A
35B
37A
31
33
35G
30A
32
35C
30C
13B
35D
37B

【図8】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26A
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13A
13
26
13E
35
31A
14
35A
34
36A
31
18A
12A
28
35B
23
18B
25
37A
24
30A
32
17
12B
41
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50
35G
35C
33A
12C
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35D
33
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27A
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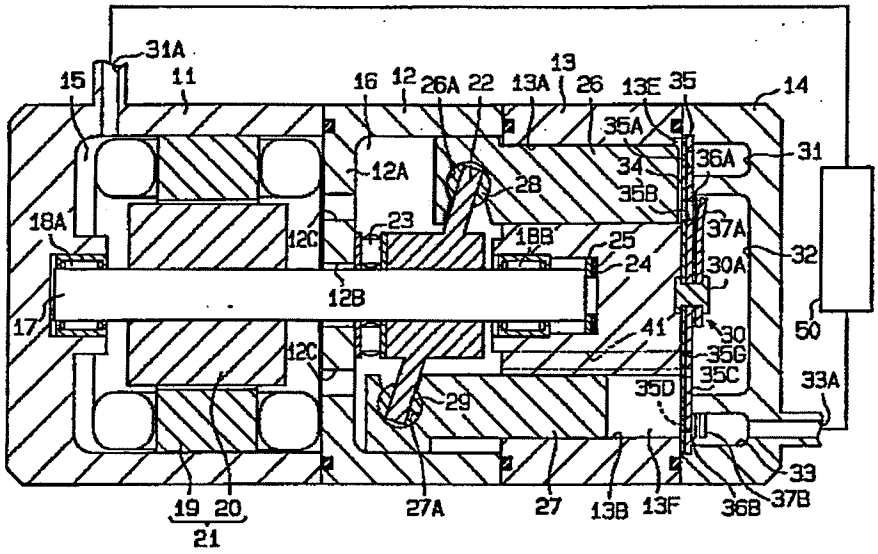
13B
13F
36B
37B
7

【図9】



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CC20 CC92 CC93 CC94 CC97